Technical Report No. 155

U.S. IBP GRASSLAND BIOME LITERATURE:

A KWIC INDEX AND ABSTRACTS

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GRASSLAND BIOME

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ABSTRACT

A total of 311 articles originating from the efforts of the U.S. IBP Grassland Biome Program up to 1971 have been abstracted and indexed in this report. Indices include a KWIC index (Key Word In Context) and a SWIT index (Significant Word In Title). In all, 474 key words have been used. The key words were allotted to each article on the basis of its entire text. Instructions for the use of the indices are detailed in the report.

INTRODUCTION

A significant amount of information has been generated by the U.S. IBP Grassland Biome Program since its inception in 1967. This information is scattered in the form of various kinds of reports like Progress Reports, Annual Reports, Technical Reports, publications in the Range Science Department Science Series, and Technical Journals. This makes the search for information on specific topics rather difficult. The desire was felt, therefore, to collect the abstracts of all the documents produced directly or indirectly through the efforts of this program up to 1971 under a single cover with a suitable index. This would not only facilitate the search for information by individual investigators participating in the program, but would also help in the synthesis and modelling efforts.

The following sources were selected for this purpose:

- U.S. IBP Grassland Biome Technical Reports No. 1-138.
- Range Science Department Science Series No. 2, 3, 5, 6, 7, 10.
- Biome Proposal 1967.
- Progress Reports and Continuation Proposals, 1969, 1970, 1971.
- Annual Reports prior to Technical Reports, 1969.
- Open literature, up to 1971.

The existing abstracts of the documents were collected. Approximately one-third of the documents did not have abstracts; for these, fresh abstracts were prepared. These abstracts are reproduced in this report on p 95.

In order to index the literature in a useful manner, it was decided to use certain key words which should be assigned to the article not only on the basis of its abstract, but on the basis of its entire text. It was also decided that the articles indexed under a particular key word should have one or more of the following items of information on the topic: Literature review, concept, parameters for state, and driving variables, or rate processes.

In evolving the list of key words, generous help was available from: David Coleman, James Ellis, John Marshall, Freeman Smith, David Swift, J. K. Lewis, George Innis, and George Van Dyne.

The list of key words used in this report is given on p. 3. The key words used for each article are included with the respective abstract. The KWIC (Key Word In Context) index thus evolved is presented on p. 6.

Another index (SWIT) based on Significant Word In Title only was also formulated and the same is included on p. 62.

Computer programs for both indices were written by Robert D. Robinson.

Instructions for Use of the Indexes:

1. Select the key word which best represents the subject you are interested in from the list of key words.
2. Locate this key word in the left-hand column of the index. The key words are arranged alphabetically.
3. See all the titles listed under this key word. Author's name and year of publication are also included along with each title.
4. If the article(s) meets your requirement, note the reference from the right-hand column of the index.

The symbols used in the reference are explained below:

TR = U.S. IBP Grassland Biome Technical Report
SS = Range Science Department Science Series
BP = Biome Proposal
PR = Progress Report and Continuation Proposal
AR = Annual Reports prior to Technical Reports
OL = Publications in open literature.

The Technical Reports (TR) are suffixed with No. 001 to 138. The Science Series volumes (SS) are suffixed with their respective numbers, followed by the page numbers of the article. The supplement of Science Series No. 2 carries the code SS02S followed by the page numbers of the article. The Biome Proposal (BP) and the Progress Reports (PR) are suffixed with the year of publication, and in the latter case this is followed by the number of the pertinent section. The Annual Reports (AR) are suffixed with the year of publication ('69), followed by the respective project number. Articles in the open literature (OL) are suffixed with simple numbers 001 to 041.

5. Once the reference for the selected article has been noted, turn to the section of abstracts and locate the abstract of the desired article with the help of this reference. The reference appears on the left-hand side of the citation for each abstract. One example is given below for each of the above categories:

Key Word	Article	Reference
1. Bacteria density	Bacterial ecology of Pawnee grassland soils. (Mayeux and Jones 1969)	AR69-2572.2
2. Bird checklist	Analysis of structure and function of grassland ecosystems, Progress Report 1969-4. (Van Dyne 1969)	PR69-4
3. Bird model	A preliminary bird population dynamics and biomass model. (Swartzman 1969)	TR003
4. Ecotype	Analysis of structure and function of grassland ecosystems, Biome Proposal 1967. (Van Dyne 1967)	BP67
5. Infiltration	The grassland hydrologic cycle. (Striffler 1969)	SS02,101-116
6. Microbial biomass	The microflora of grassland. (Clark and Paul 1970)	OL005

Abstracts for the above citations appear on pages 95, 166, 126, 165, 154, and 153, respectively.

The SWIT index also operates in a similar manner with the only exception that the left-hand column of this index contains significant words, pulled out of the title, instead of key words.

LIST OF KEY WORDS

Abiotic

Abiotic model
Air temperature
Albedo
Altitude
Aridity index
Atmospheric water
Barometric pressure
Bulk density
Climate
Compaction
CO_2 ambient
CO_2 transfer
Energy balance
Erosion
Evaporation
Evaporation model
Evapotranspiration
Fertilization
Field capacity
Fire
Growing season
Heat balance
Heat transfer
Hydrological cycle
Hydrology
Infiltration
Infiltration rate
Instrumentation
Interception
Irrigation
Latitude
Light spectrum
Lysimeter
Mean particle size
Meteorology
Microwatersheds
Microclimate
Mineralization
Moisture index
Moisture stress
Net radiation
Nitrification
Nitrogen
Nitrogen cycle
Nitrogen turnover
Pond chemical characteristics
Pond physical characteristics
Ponds
Potential evaporation
Potential evapotranspiration
Precipitation
Precipitation model
Profile development
Reflectivity
Runoff
Snow
Snow fence
Soil aeration
Soil chemical characteristics
Soil depth
Soil heat flux
Soil movement
Soil nitrogen
Soil physical characteristics
Soil temperature
Soil types
Soil water
Soil water hierarchical diagram
Solar radiation
Solar radiation hierarchical diagram
Solum depth
Texture
Topography
Vapor pressure
Water balance
Water cycle
Water potential
Water storage
Watershed
Wind

Producer

Aboveground plant biomass
Annual increment
Anthesis
Belowground plant biomass
Biomass category relationship
Biomass family relationship
Blue grama
Bluestem
Buffalo grass
C-3 pathway
C-4 pathway
Carbon dioxide exchange
Community replacement
Competition
Cool forb
Cool grass
Cool shrub
Cool succulent
Cover
Dispersion
Ecotype
Efficiency energy capture
Energy flow
Growth analysis
Growth rate
Leaf area
Leaf area index
Leaf height
Litter
Litter accumulation
Longevity
Needleleaf sedge
Net photosynthesis
Phenology
Photosynthesis
Phytoplankton
Phytoplankton checklist
Phytoplankton productivity
Plant checklist
Plant competition
Plant cover
Plant diversity
Plant energetics
Plant fragment identification
Plant growth
Plant growth model
Plant nutrients
Plant nutrition
Plant pattern
Plant respiration
Prickly pear
Primary production
Producer hierarchical diagram
Producer model
Respiration
Root annual increment
Root turnover
Scarlet globemallow
Seedling survival
Shoot-root ratio
Shortgrass
Species association
Species diversity
Standing dead
Succession
System transfer function
Translocation
Transpiration
Vegetation structure
Vegetation types
Warm forb
Warm grass
Warm shrub
Warm succulent
Water efficiency
Western wheatgrass
Wheat
Wheatgrass
Yield

Consumer

Age structure
Amphibian
Amphibian checklist
Amphibian ecology
Amphibian population
Ant
Antelope
Antelope energy flow
Antelope excretion

Antelope metabolism
Antloving beetle
Aphid
Beetle
Beetle systematics
Bird biomass
Bird checklist
Bird density
Bird distribution
Bird diversity
Bird energetics
Bird energy flow
Bird growth
Bird habitat
Bird migration
Bird model
Bird pattern
Bird population
Bird production
Bird reproduction
Birds
Birth rate
Bison
Breeding rate
Brewer's Sparrow
Brewer's Sparrow production
Bug
Carnivore
Cattle
Cattle biomass
Cattle excretion
Cattle growth
Cattle metabolism
Cattle nutrition
Cattle production
Chewing arthropods
Clutch size
Collembolans
Competition
Consumer hierarchical diagram
Consumer model
Consumer predation model
Consumption rate
Cottontail
Cottontail density
Cricket
Darkling beetle
Deer
Deermice
Deermice density
Demography
Dickcissel
Dietary matrix
Digestion
Diplopods
Diseases
Dispersion
Eagle
Egestion
Eland
Enchytraeids
Energy flow
Excretion
Falcon
Feeding habit
Fistula
Food chemical composition
Food composition
Food consumption
Food preference
Food web
Froghopper
Gall gnat
Gestation
Goat
Golden Eagle
Grasshopper
Grasshopper biomass
Grasshopper checklist
Grasshopper mouse
Grasshopper Sparrow
Grazing influence
Grazing intensity
Grazing travel
Ground beetle
Ground squirrel
Ground squirrel density
Growth rate
Habitat
Hawk
Herbivory
Homing range
Horned Lark
Horned Lark production
Ingestion
Insect biomass
Insect checklist
Insect density
Insect food web
Insect fragment identification
Insect phenology
Insect population
Insect respiration
Insect systematics
Insects
Isopods
Jackrabbit
Jackrabbit biomass
Jackrabbit density
Jackrabbit distribution
Jackrabbit growth
Jackrabbit home range
Kangaroo rat
Killdeer
Lace bug
Lactation
Ladybird beetle
Lagomorph
Lark Bunting
Lark Bunting production
Leaf beetle
Leaf bug
Leafhopper
Leafhopper checklist
Life history
Lizard
Lizard biomass
Lizard density
Mammal assimilation
Mammal biomass
Mammal checklist
Mammal density
Mammal diversity
Mammal energetics
Mammal energy flow
Mammal metabolic rate
Mammal metabolism
Mammal model
Mammal nutrition
Mammal population
Mammal production
Mammals
McCown's Longspur
McCown's Longspur production
McCown's Sparrow
Meadowlark
Meadowlark production
Metabolic rate
Metabolism
Migration
Mite
Mortality
Mountain Plover
Mountain Plover production
Mourning Dove
Natality
Nesting
Owl
Owl prey
Parasites
Phenology
Plant hopper
Pocket gopher
Pocket gopher density
Pocket mouse
Predation
Pronghorn
Pronghorn metabolism
Raptor
Raptor biomass
Reproduction
Reptile biomass
Reptile checklist
Reptile density
Reptile ecology
Reptile growth
Reptiles
Reptiles population
Respiration
Rodent
Rodent biomass
Rodent density
Rodent embryo
Rodent population
Rough-legged Hawk
Rove beetle
Rumen
Scale
Scavenger beetle
Seed bug
Sex ratio
Sheep
Sheep nutrition
Short-horned grasshopper
Signiodon
Snake
Snake biomass
Snake density
Spatial overlap
Species association
Species diversity
Spider
Steer metabolism
Steers
Stinkbug
Stocking rate
Sucking arthropods
Swainson's Hawk
Territoriality
Thrips
Urine output
Vole
Water turnover
Weevil
Wildebeest
Zooplankton checklist

Decomposer

Actinomycetes
Algae
Bacteria
Bacteria biomass
Bacteria density
Bacteria population
Decomposer ecology
Decomposer energetics
Decomposer model
Decomposition
Decomposition cellulose
Decomposition litter
Decomposition plant
Decomposition root
Decomposition soil organic matter
Decomposition standing dead
Earthworms
Energy flow
Exudate
Fungi
Fungi biomass
Fungi population
Lichens
Litter decomposition
Microbial activity
Microbial biomass
Microbial density
Microbial energetics
Microbial energy flow
Microbial hierarchical diagram
Microbial population
Microflora
Mollusks
Nematodes
Nitrogen fixation
Protozoa
Reducers
Rhizosphere
Root decomposition
Soil ATP
Soil biochemistry
Soil fauna
Soil fauna population
Soil respiration

Site

ALE
Bison
Bridger
Central basin
Cottonwood
Dickinson
Hays
Hopland
Jornada
Osage
Pantex
Pawnee

Miscellaneous

Agreements
Biome objectives
Budget
Calorimetry
Computer programs
CO_2 analysis system
Data acquisition
Data processing
Differential equation
Ecosystem model
Ecosystem stress
Field data procedures
Grazing influence
Intersite comparison
Jornada model
Modelling concept
Models
Multivariate generator
Optimization
Pawnee model
Personnel vitae
Principal component analysis
Range condition
Resource model
Sample processing
Sample storage
Simulation
Site description
Site phenology
Spectrophotometer lab
Style technical report
Symposia report
Trip report
Weight estimate method

KWIC INDEX

Key Word In Context

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5. Once the reference for the selected article has been noted, turn to the section of abstracts and locate the abstract of the desired article with the help of this reference. The reference appears on the left-hand side of the citation for each abstract.

KEY-WORD	ARTICLE	REFERENCE
ABIOTIC-MODEL	SOME CONCEPTS OF MODELLING. (SWARTZMAN, ET. AL. 1970)	TR032
ABOVEGROUND-PLANT-BIOMASS	PRELIMINARY METHODOLOGY AND RESULTS FOR ABOVEGROUND HERBAGE BIOMASS SAMPLING ON THE PAWNEE SITE. (URESK AND SIMS 1969)	TR033
ABOVEGROUND-PLANT-BIOMASS	HERBAGE DYNAMICS STUDIES AT THE PANTEX SITE. (FAGAN AND PETTIT 1971)	TR078
ABOVEGROUND-PLANT-BIOMASS	OSAGE SITE, 1970 REPORT, PRIMARY PRODUCTION. (RISSER 1971)	TR080
ABOVEGROUND-PLANT-BIOMASS	SITE COMPARISONS OF ABOVEGROUND PLANT BIOMASS, 1970 SEASON. (GRANT 1971)	TR083
ABOVEGROUND-PLANT-BIOMASS	THE BRIDGER SITE. 1970 PROGRESS REPORT. (COLLINS 1971)	TR084
ABOVEGROUND-PLANT-BIOMASS	HERBAGE DYNAMICS ON A MIXED PRAIRIE GRASSLAND NEAR HAYS, KANSAS. (HULETT AND TOMANEK 1971)	TR108
ABOVEGROUND-PLANT-BIOMASS	HERBAGE DYNAMICS ON THE PAWNEE SITE: ABOVEGROUND AND BELOWGROUND HERBAGE DYNAMICS ON THE FOUR GRAZING INTENSITY TREATMENTS; AND PRELIMINARY SAMPLING ON THE ECOSYSTEM STRESS SITE. (SIMS, ET. AL. 1971)	TR099
ABOVEGROUND-PLANT-BIOMASS	PRELIMINARY REPORT ON SAMPLING OF PRIMARY PRODUCERS, INVERTEBRATES, AND DECOMPOSERS ON THE JORNADA SITE, 1970. (PIEPER, ET. AL. 1971)	TR105
ABOVEGROUND-PLANT-BIOMASS	HERBAGE GROWTH RATE, FORAGE INTAKE, AND FORAGE QUALITY IN 1970 ON HEAVILY AND LIGHTLY GRAZED BLUE GRAMA PASTURES. (DYCK AND BEMENT 1971)	TR094
ABOVEGROUND-PLANT-BIOMASS	ABIOTIC AND HERBAGE DYNAMICS STUDIES ON THE COTTONWOOD SITE, 1970. (LEWIS, ET. AL. 1971)	TR111
ABOVEGROUND-PLANT-BIOMASS	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
ABOVEGROUND-PLANT-BIOMASS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.5. (VAN DYNE 1970)	PR70-2.5
ABOVEGROUND-PLANT-BIOMASS	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.4. (VAN DYNE 1971)	PR71-2.4
ABOVEGROUND-PLANT-BIOMASS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
ABOVEGROUND-PLANT-BIOMASS	PRIMARY PRODUCTIVITY AND ABIOTIC STUDIES AT THE DICKINSON SITE, 1970 SEASON. (WHITMAN 1971)	TR116
ABOVEGROUND-PLANT-BIOMASS	COMPARISONS OF ABOVEGROUND PLANT BIOMASS ON UNGRAZED PASTURES VS. PASTURES GRAZED BY LARGE HERBIVORES, 1970 SEASON. (GRANT 1971)	TR131
ABOVEGROUND-PLANT-BIOMASS	PRIMARY PRODUCTIVITY OF THE FESCUE GRASSLAND IN WESTERN MONTANA. (MORRIS AND BRUNNER 1971)	TR113
ABOVEGROUND-PLANT-BIOMASS	SOIL NUTRIENT-PLANT NUTRIENT RELATIONSHIPS AT THE PAWNEE SITE. (DITTBERNER 1971)	TR122
ABOVEGROUND-PLANT-BIOMASS	PRIMARY PRODUCERS IN GRASSLAND ECOSYSTEMS. (LEWIS 1970)	SS02S241,1-87
ABOVEGROUND-PLANT-BIOMASS	PLANT COMMUNITY STRUCTURE. (RISSER 1971)	SS10,41-58
ABOVEGROUND-PLANT-BIOMASS	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
ABOVEGROUND-PLANT-BIOMASS	PRELIMINARY METHODOLOGY AND RESULTS FOR ABOVEGROUND HERBAGE BIOMASS SAMPLING ON THE PAWNEE SITE. (SIMS 1969)	AR69-2552.1
ABOVEGROUND-PLANT-BIOMASS	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
ABOVEGROUND-PLANT-BIOMASS	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.6. (VAN DYNE 1971)	PR71-2.6
ABOVEGROUND-PLANT-BIOMASS	MODELS OF SEASONAL PRIMARY PRODUCTIVITY IN EASTERN TENNESSEE FESTUCA AND ANDROPOGON ECOSYSTEMS. (KELLY, ET. AL. 1969)	OL028
ACTINOMYCETES	THE MICROFLORA OF GRASSLAND. (CLARK AND PAUL 1970)	OL005
ACTINOMYCETES	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTIONS. (CLARK 1969)	SS02,361-376
ACTINOMYCETES	MICROBIAL DECOMPOSER ACTIVITIES AT THE PAWNEE SITE: INTEGRATION OF EXPERIMENTAL APPROACHES WITH PROGRAM MODELLING REQUIREMENTS. (KLEIN 1971)	TR110
ACTINOMYCETES	MICROBIOLOGICAL STUDIES AT THE OSAGE SITE, 1970. (HARRIS 1971)	TR102
AGE-STRUCTURE	DIETARY AND ENERGY RELATIONSHIPS OF JACKRABBITS AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	TR014
AGE-STRUCTURE	A STUDY OF RODENTS IN NORTHEASTERN COLORADO. (FLAKE, 1969)	TR015
AGE-STRUCTURE	DIETS AND ENERGY RELATIONS OF JACKRABBITS AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	AR69-2562
AGREEMENTS	MEMORANDA OF AGREEMENT AND PROCEDURES FOR WORKING ON FEDERAL LANDS OF THE USDA. (JAMESON AND NELL 1970)	TR008
AIR-TEMPERATURE	AN ECOLOGICAL STUDY OF RODENTS IN A SHORTGRASS PRAIRIE OF NORTHEASTERN COLORADO. (FLAKE 1971)	TR100

KEY-WORD	ARTICLE	REFERENCE
AIR-TEMPERATURE	HERBAGE DYNAMICS ON A MIXED PRAIRIE GRASSLAND NEAR HAYS, KANSAS. (HULETT AND TOMANEK 1971)	TR108
AIR-TEMPERATURE	ABIOTIC AND HERBAGE DYNAMICS STUDIES ON THE COTTONWOOD SITE, 1970. (LEWIS, ET. AL. 1971)	TR111
AIR-TEMPERATURE	OSAGE SITE, 1970 REPORT, PRIMARY PRODUCTION. (RISSER 1971)	TR080
AIR-TEMPERATURE	METEOROLOGICAL DATA ACQUISITION SYSTEM, SEPTEMBER 1, 1970 - DECEMBER 31, 1970. (NUNN, ET. AL. 1971)	TR073
AIR-TEMPERATURE	THE BRIDGER SITE, 1970 PROGRESS REPORT. (COLLINS 1971)	TR084
AIR-TEMPERATURE	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
AIR-TEMPERATURE	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
AIR-TEMPERATURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.53 . (VAN DYNE 1969)	PR69-8.53
AIR-TEMPERATURE	THE IMPACT OF DOMESTIC ANIMALS ON THE FUNCTION AND STRUCTURE OF GRASSLAND ECOSYSTEMS. (HYDER 1969)	SS02,243-260
AIR-TEMPERATURE	MACROCLIMATE AND THE GRASSLAND ECOSYSTEM. (COLLINS 1969)	SS02,29-39
AIR-TEMPERATURE	DYNAMICS OF THE ATMOSPHERE IN THE GRASSLAND ECOSYSTEM. (POCHOP 1969)	SS02,89-100
AIR-TEMPERATURE	PRIMARY PRODUCTIVITY OF THE FESCUE GRASSLAND IN WESTERN MONTANA. (MORRIS AND BRUNNER 1971)	TR113
AIR-TEMPERATURE	PRIMARY PRODUCTIVITY AND ABIOTIC STUDIES AT THE DICKINSON SITE, 1970 SEASON. (WHITMAN 1971)	TR116
AIR-TEMPERATURE	GRASSLAND CLIMATOLOGY OF THE PAWNEE GRASSLAND. (RASMUSSEN, ET. AL. 1971)	TR127
AIR-TEMPERATURE	RESULTS OF WORKSHOP GROUPS. (WRIGHT AND VAN DYNE 1970)	SS06II,1-69
AIR-TEMPERATURE	ABIOTIC FACTORS IN GRASSLAND ECOSYSTEM ANALYSIS AND FUNCTION. (RASMUSSEN 1971)	SS10,11-34
AIR-TEMPERATURE	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
AIR-TEMPERATURE	SOME ASPECTS OF THE ECOLOGICAL CLIMATOLOGY OF THE JORNADA EXPERIMENTAL RANGE NEW-MEXICO. (BRYSON, ET. AL. 1970)	SS06I,2-74
AIR-TEMPERATURE	A QUANTITATIVE ECOLOGY OF THE JORNADA EXPERIMENTAL RANGE. (HERBEL, ET. AL. 1970)	SS06I,133-177
AIR-TEMPERATURE	PRELIMINARY REPORT ON THE STUDY OF THE CLIMATOLOGY OF THE PAWNEENATIONAL GRASSLAND. (BERTOLIN AND RASMUSSEN 1969)	AR69-2532.1
AIR-TEMPERATURE	METEOROLOGICAL CHARACTERISTICS OF HEAVILY AND LIGHTLY GRAZED NATURAL GRASS RANGE LAND . (NUNN, ET. AL. 1971)	OL015
ALBEDO	METEOROLOGICAL CHARACTERISTICS OF HEAVILY AND LIGHTLY GRAZED NATURAL GRASS RANGE LAND . (NUNN, ET. AL. 1971)	OL015
ALBEDO	RESULTS OF WORKSHOP GROUPS. (WRIGHT AND VAN DYNE 1970)	SS06II,1-69
ALE	SOILS OF THE GRASSLAND BIOME SITES. (REUSS 1971)	SS10,35-40
ALE	ABIOTIC FACTORS IN GRASSLAND ECOSYSTEM ANALYSIS AND FUNCTION. (RASMUSSEN 1971)	SS10,11-34
ALE	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
ALE	COMPREHENSIVE NETWORK SITE DESCRIPTION, ALE. (RICKARD AND OFARRELL 1970)	TR036
ALGAE	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTIONS. (CLARK 1969)	SS02,361-376
ALGAE	THE MICROFLORA OF GRASSLAND. (CLARK AND PAUL 1970)	OL005
ALGAE	PRELIMINARY REPORT. (SHERMAN AND SHERMAN 1969)	AR69-2553.3
ALTITUDE	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
AMPHIBIAN	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
AMPHIBIAN	THE IMPORTANCE AND ROLE OF AMPHIBIANS AND REPTILES IN GRASSLAND ECOSYSTEMS. (THOMAS 1970)	SS02S307,1-23
AMPHIBIAN-CHECKLIST	THE IMPORTANCE AND ROLE OF AMPHIBIANS AND REPTILES IN GRASSLAND ECOSYSTEMS. (THOMAS 1970)	SS02S307,1-23
AMPHIBIAN-CHECKLIST	COMPREHENSIVE NETWORK SITE DESCRIPTION, COTTONWOOD. (LEWIS 1970)	TR039
AMPHIBIAN-ECOLOGY	THE IMPORTANCE AND ROLE OF AMPHIBIANS AND REPTILES IN GRASSLAND ECOSYSTEMS. (THOMAS 1970)	SS02S307,1-23
AMPHIBIAN-POPULATION	THE IMPORTANCE AND ROLE OF AMPHIBIANS AND REPTILES IN GRASSLAND ECOSYSTEMS. (THOMAS 1970)	SS02S307,1-23
ANNUAL-INCREMENT	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124

KEY-WORD	ARTICLE	REFERENCE
ANT	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
ANT	ABOVEGROUND INSECTS ON THE PAWNEE SITE, 1970. (DICKINSON AND LEETHAM 1971)	TR123
ANT	EFFECT OF INSECT PREDATORS AND PARASITES ON GRASS FEEDING INSECTS, PAWNEE SITE. (LAVIGNE AND ROGERS 1970)	TR020
ANT	STUDIES OF POPULATIONS OF ADULTS AND IMMATURE INSECTS AND MITES FROM TWO TREATMENTS AT COTTONWOOD, SOUTH DAKOTA. (MCDANIEL 1971)	TR112
ANT	DATA COLLECTED ON THE PAWNEE SITE RELATING TO WESTERN HARVESTER ANT AND INSECT PREDATORS AND PARASITES, 1970. (LAVIGNE, ET. AL. 1971)	TR107
ANT	THE ROLE OF INVERTEBRATES IN THE GRASSLAND BIOME. (MCDANIEL 1971)	SS10,267-315
ANT	THE EFFECT OF INSECT PREDATORS AND PARASITES ON GRASS FEEDING INSECTS. (LAVIGNE 1969)	AR69-2564.3
ANTELOPE	IBP ANTELOPE PROJECT PROGRESS REPORT. (NAGY, ET. AL. 1969)	AR69-2561.4
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BIRDS	AVIAN POPULATIONS AT THE PAWNEE SITE. (RYDER 1969)	AR69-2563.2
BIRDS	SUMMER ECOLOGY OF THE LARK-BUNTING IN NORTH-CENTRAL COLORADO. (CREIGHTON 1969)	AR69-2563.1
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C-3-PATHWAY	PRODUCER FUNCTION ON THE INTENSIVE AND COMPREHENSIVE SITES. (WILLIAMS 1971)	SS10,125-132
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CATTLE	THE IMPACT OF DOMESTIC ANIMALS ON THE FUNCTION AND STRUCTURE OF GRASSLAND ECOSYSTEMS. (HYDER 1969)	SS02,243-260
CATTLE	WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTIONING BY CATTLE. (HYDER 1969)	AR69-2561.1
CATTLE	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMED BY GRAZ ING CATTLE. (WALLACE AND VAN DYNE 1970)	OL038
CATTLE	ESTIMATING DRY WEIGHTS OF FOOD PLANTS IN FECES OF HERBIVORES. (FREE, ET. AL. 1970)	OL003
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CATTLE-GROWTH	FUNCTIONAL INTERACTION OF LARGE HERBIVORES ON GRASSLANDS. (RICE, ET. AL. 1971)	SS10,241-266
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CHEWING-ARTHROPODS	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
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COLLEMBOLANS	THE ROLE OF INVERTEBRATES IN THE GRASSLAND BIOME. (MCDANIEL 1971)	SS10,267-315
COLLEMBOLANS	STUDIES OF POPULATIONS OF ADULTS AND IMMATURE INSECTS AND MITES FROM TWO TREATMENTS A T COTTONWOOD, SOUTH DAKOTA. (MCDANIEL 1971)	TR112
COLLEMBOLANS	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
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COMMUNITY-REPLACEMENT	REPLACEMENT OF NATIVE COMMUNITIES WITH INTRODUCED COMMUNITIES AND ITS IMPACT ON ECOSY STEM FUNCTION. (EVERSON 1969)	AR69-2552.2
COMPACTION	THE IMPACT OF DOMESTIC ANIMALS ON THE FUNCTION AND STRUCTURE OF GRASSLAND ECOSYSTEMS. (HYDER 1969)	SS02,243-260
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CONSUMER-MODEL	SOME CONCEPTS OF MODELLING. (SWARTZMAN, ET. AL. 1970)	TR032
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CONSUMPTION-RATE	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
COOL-FORB	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
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COOL-GRASS	PLANT COMMUNITY STRUCTURE. (RISSER 1971)	SS10,41-58
COOL-GRASS	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
COOL-GRASS	OSAGE SITE, 1970 REPORT, PRIMARY PRODUCTION. (RISSER 1971)	TR080
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COOL-SHRUB	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
COOL-SUCCULENT	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
COTTON-TAIL	THE ROLE OF HERBIVOROUS MAMMALS IN THE FUNCTIONING OF THE GRASSLAND ECOSYSTEM. (GROSS 1969)	SS02,268-278
COTTON-TAIL	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
COTTON-TAIL-DENSITY	THE ROLE OF HERBIVOROUS MAMMALS IN THE FUNCTIONING OF THE GRASSLAND ECOSYSTEM. (GROSS 1969)	SS02,268-278
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COVER	PSYCHROMETRY IN WATER RELATIONS RESEARCH: A REVIEW. (VAN HAVEREN 1971)	TR132
COVER	VALUE OF BROOM SNAKEWEED AS A RANGE CONDITION INDICATOR. (JAMESON 1970)	OL004
CO2-AMBIENT	CO2 EXCHANGE OVER SHORTGRASS SODS. (DYE AND MOIR 1971)	TR081
CO2-ANALYSIS-SYSTEM	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-4. (VAN DYNE 1969)	PR69-4.
CO2-TRANSFER	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-6. (VAN DYNE 1969)	PR69-6.
CRICKET	THE ROLE OF INVERTEBRATES IN THE GRASSLAND BIOME. (MCDANIEL 1971)	SS10,267-315

KEY-WORD	ARTICLE	REFERENCE
CRICKET	DIETARY SIMILARITY OF SOME PRIMARY CONSUMERS. (HANSEN AND UECKERT 1970)	OL025
DARKLING-BEETLE	IDENTIFYING TENEBRIONIDAE (DARKLING BEETLES). (BELL 1970)	TR058
DATA-ACQUISITION	DATA AEQUISITION, STORAGE, AND RETRIEVAL FOR SOME RANGE ECOSYSTEM PLANNING. (SHIFLET 1970)	SS05,101-110
DATA-PROCESSING	DATA AEQUISITION, STORAGE, AND RETRIEVAL FOR SOME RANGE ECOSYSTEM PLANNING. (SHIFLET 1970)	SS05,101-110
DECOMPOSER-ECOLOGY	SOIL DECOMPOSERS. (ALEXANDER 1969)	SS02,403-409
DECOMPOSER-ECOLOGY	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
DECOMPOSER-ENERGETICS	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
DECOMPOSER-MODEL	SOME CONCEPTS OF MODELLING. (SWARTZMAN, ET. AL. 1970)	TR032
DECOMPOSITION	DECOMPOSITION OF ORGANIC MATERIALS IN GRASSLAND SOIL. (CLARK 1970)	TR061
DECOMPOSITION	MICROBIAL MEASUREMENTS AT THE PANTEX SITE. 1970. (BOULETTE, ET. AL. 1971)	TR095
DECOMPOSITION	OSAGE SITE. 1970 REPORT. PRIMARY PRODUCTION. (RISSER 1971)	TR080
DECOMPOSITION	MICROBIOLOGICAL STUDIES AT THE OSAGE SITE. 1970. (HARRIS 1971)	TR102
DECOMPOSITION	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
DECOMPOSITION	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
DECOMPOSITION	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTION S. (CLARK 1969)	SS02,361-376
DECOMPOSITION	DECOMPOSER STUDIES AT THE COTTONWOOD SITE. (TURNER AND PENGRA 1971)	TR126
DECOMPOSITION	DECOMPOSER AND NITROGEN CYCLING INVESTIGATIONS IN THE GRASSLAND BIOME. (REUSS 1971)	SS10,133-146
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DECOMPOSITION	THE MICROFLORA OF GRASSLAND. (CLARK AND PAUL 1970)	OL005
DECOMPOSITION	PROPOSAL FOR A CELLULOSE DECOMPOSITION STUDY AT THE PAWNEE SITE. (CLARK 1969)	AR69-2572.3
DECOMPOSITION-CELLULOSE	PROPOSAL FOR A CELLULOSE DECOMPOSITION STUDY AT THE PAWNEE SITE. (CLARK 1969)	AR69-2572.3
DECOMPOSITION-CELLULOSE	DECOMPOSER AND NITROGEN CYCLING INVESTIGATIONS IN THE GRASSLAND BIOME. (REUSS 1971)	SS10,133-146
DECOMPOSITION-CELLULOSE	DECOMPOSER STUDIES AT THE COTTONWOOD SITE. (TURNER AND PENGRA 1971)	TR126
DECOMPOSITION-CELLULOSE	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
DECOMPOSITION-CELLULOSE	MICROBIOLOGICAL STUDIES AT THE OSAGE SITE. 1970. (HARRIS 1971)	TR102
DECOMPOSITION-CELLULOSE	DECOMPOSITION OF ORGANIC MATERIALS IN GRASSLAND SOIL. (CLARK 1970)	TR061
DECOMPOSITION-LITTER	MICROBIAL MEASUREMENTS AT THE PANTEX SITE. 1970. (BOULETTE, ET. AL. 1971)	TR095
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DECOMPOSITION-LITTER	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTION S. (CLARK 1969)	SS02,361-376
DECOMPOSITION-LITTER	DYNAMICS OF MULCH LAYER IN GRASSLAND ECOSYSTEMS. (TOMANEK 1969)	SS02,225-240
DECOMPOSITION-LITTER	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
DECOMPOSITION-LITTER	THE MICROFLORA OF GRASSLAND. (CLARK AND PAUL 1970)	OL005
DECOMPOSITION-PLANT	DECOMPOSER AND NITROGEN CYCLING INVESTIGATIONS IN THE GRASSLAND BIOME. (REUSS 1971)	SS10,133-146
DECOMPOSITION-PLANT	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
DECOMPOSITION-PLANT	MICROBIOLOGICAL STUDIES AT THE OSAGE SITE. 1970. (HARRIS 1971)	TR102
DECOMPOSITION-PLANT	DECOMPOSITION OF ORGANIC MATERIALS IN GRASSLAND SOIL. (CLARK 1970)	TR061
DECOMPOSITION-ROOT	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
DECOMPOSITION-SOIL-ORGANIC-MAT	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTION S. (CLARK 1969)	SS02,361-376
DECOMPOSITION-SOIL-ORGANIC-MAT	DECOMPOSITION OF ORGANIC MATERIALS IN GRASSLAND SOIL. (CLARK 1970)	TR061
DECOMPOSITION-STANDING-DEAD	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTION S. (CLARK 1969)	SS02,361-376
DEER	FUNCTIONAL INTERACTION OF LARGE HERBIVORES ON GRASSLANDS. (RICE, ET. AL. 1971)	SS10,241-266
DEERMICE	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
DEERMICE	THE ROLE OF HERBIVOROUS MAMMALS IN THE FUNCTIONING OF THE GRASSLAND ECOSYSTEM. (GROSS 1969)	SS02,268-278

KEY-WORD	ARTICLE	REFERENCE
DEERMICE-DENSITY	THE ROLE OF HERBIVOROUS MAMMALS IN THE FUNCTIONING OF THE GRASSLAND ECOSYSTEM. (GROSS 1969)	SS02,268-278
DEMOGRAPHY	JACKRABBIT DEMOGRAPHIC AND LIFE HISTORY STUDIES, PAWNEE SITE. (GROSS 1969)	TR016
DICKCISSEL	PATTERN AND PROCESS IN GRASSLAND BIRD COMMUNITIES. (WIENS 1971)	SS10,147-212
DICKINSON	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
DICKINSON	ABIOTIC FACTORS IN GRASSLAND ECOSYSTEM ANALYSIS AND FUNCTION. (RASMUSSEN 1971)	SS10,11-34
DICKINSON	PLANT COMMUNITY STRUCTURE. (RISSER 1971)	SS10,41-58
DICKINSON	SOILS OF THE GRASSLAND BIOME SITES. (REUSS 1971)	SS10,35-40
DICKINSON	PRIMARY PRODUCTIVITY AND ABIOTIC STUDIES AT THE DICKINSON SITE, 1970 SEASON. (WHITMAN 1971)	TR116
DICKINSON	COMPREHENSIVE NETWORK SITE DESCRIPTION, DICKINSON. (WHITMAN 1970)	TR040
DICKINSON	SMALL MAMMAL SURVEY ON THE BISON, BRIDGER, COTTONWOOD, DICKINSON, AND OSAGE SITES. (HOFFMANN, ET. AL. 1971)	TR109
DICKINSON	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
DICKINSON	THE ROLE OF INVERTEBRATES IN THE GRASSLAND BIOME. (MCDANIEL 1971)	SS10,267-315
DICKINSON	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
DIETARY-MATRIX	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
DIETARY-MATRIX	FUNCTIONAL INTERACTION OF LARGE HERBIVORES ON GRASSLANDS. (RICE, ET. AL. 1971)	SS10,241-266
DIETARY-MATRIX	DIETARY SIMILARITY OF SOME PRIMARY CONSUMERS. (HANSEN AND UECKERT 1970)	OL025
DIFFERENTIAL-EQUATION	ODE: NUMERICAL ANALYSIS FOR ORDINARY DIFFERENTIAL EQUATIONS. (BLEDSOE 1970)	TR046
DIGESTION	BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF STEERS GRAZING LIGHT, MEDIUM, AND HEAVY USE SHORTGRASS RANGE. (RICE AND VAVRA 1969)	TR012
DIGESTION	BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF CATTLE AND SHEEP GRAZING SHORTGRASS PRAIRIE. (RICE AND VAVRA 1971)	TR103
DIGESTION	METABOLIC STUDIES OF PRONGHORN ANTELOPE. (NAGY, ET. AL. 1971)	TR088
DIGESTION	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
DIGESTION	FUNCTIONAL INTERACTION OF LARGE HERBIVORES ON GRASSLANDS. (RICE, ET. AL. 1971)	SS10,241-266
DIGESTION	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-6. (VAN DYNE 1969)	PR69-6.
DIGESTION	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-4. (VAN DYNE 1969)	PR69-4.
DIGESTION	PRELIMINARY ACTIVITIES AND RESULTS IN BISON RESEARCH ON THE PAWNEE SITE. (PEDEN 1971)	TR121
DIGESTION	METABOLIC COMPONENTS OF CATTLE UNDER LIGHT AND HEAVY RATES OF STOCKING IN 1970. (HYDER, ET. AL. 1971)	TR128
DIGESTION	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMED BY GRAZING CATTLE. (WALLACE AND VAN DYNE 1970)	OL006
DIGESTION	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMED BY GRAZING CATTLE. (WALLACE AND VAN DYNE 1970)	OL038
DIGESTION	BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF STEERS GRAZING LIGHT, MEDIUM AND HEAVY USE. (RICE AND VAVRA 1969)	AR69-2561.3
DIGESTION	A COMPARISON OF THE ESOPHAGEAL OR RUMEN GRAB SAMPLING FOR THE BOTANICAL AND CHEMICAL DETERMINATION OF GRAZING SHEEP. (RICE AND CUNDY 1969)	AR69-2561.2
DIPLOPODS	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
DIPLOPODS	STUDIES OF POPULATIONS OF ADULTS AND IMMATURE INSECTS AND MITES FROM TWO TREATMENTS AT COTTONWOOD, SOUTH DAKOTA. (MCDANIEL 1971)	TR112
DISEASES	THE ROLE OF DISEASES AND PARASITES IN A GRASSLAND ECOSYSTEM. (POST 1969)	SS02,300-306
DISPERSION	DISPERSION AND DISPERSAL OF WHITE-TAILED AND BLACK-TAILED JACKRABBITS, PAWNEE NATIONAL GRASSLANDS. (DONOHO 1971)	TR096
DISPERSION	JACKRABBIT DEMOGRAPHIC AND LIFE HISTORY STUDIES, PAWNEE SITE. (GROSS 1969)	TR016
DISPERSION	PRELIMINARY REPORT OF METHODOLOGY AND RESULTS FOR ANALYSIS OF PLANT PATTERN SUBPROJECT RESEARCH ON THE PAWNEE SITE. (FISSER 1969)	TR009
EAGLE	DIURNAL RAPTORS ON THE PAWNEE SITE. (RYDER 1969)	TR026
EAGLE	PATTERN AND PROCESS IN GRASSLAND BIRD COMMUNITIES. (WIENS 1971)	SS10,147-212
EAGLE	AVIAN POPULATIONS AT THE PAWNEE SITE. (RYDER 1969)	AR69-2563.2
EARTHWORMS	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
ECOSYSTEM-MODEL	MODEL STRUCTURE FOR A GRASSLAND ECOSYSTEM. (BLEDSOE AND JAMESON 1969)	SS02,410-437

KEY-WORD	ARTICLE	REFERENCE
ECOSYSTEM-MODEL	GRASSLANDS MANAGEMENT, RESEARCH, AND TRAINING VIEWED IN A SYSTEMS CONTEXT. (VAN DYNE 1969)	SS03,1-39
ECOSYSTEM-MODEL	A GUIDE TO MATHEMATICAL MODELLING OF AN ECOSYSTEM. (CLYMER AND BLEDSOE 1970)	SS06I,75-99
ECOSYSTEM-MODEL	EXAMPLES OF TROPHIC LEVEL AND TOTAL ECOSYSTEM MODELS. (VAN DYNE 1970)	SS07,191-198
ECOSYSTEM-MODEL	PWNEE: A GRASSLAND ECOSYSTEM MODEL. (BLEDSOE, ET. AL. 1971)	TR064
ECOSYSTEM-MODEL	A SYSTEMS APPROACH TO GRASSLANDS. (VAN DYNE 1970)	OL034
ECOSYSTEM-STRESS	HERBAGE DYNAMICS ON THE PAWNEE SITE: ABOVEGROUND AND BELOWGROUND HERBAGE DYNAMICS ON THE FOUR GRAZING INTENSITY TREATMENTS: AND PRELIMINARY SAMPLING ON THE ECOSYSTEM STR ESS SITE. (SIMS, ET. AL. 1971)	TR099
ECOSYSTEM-STRESS	THE U.S. IBP GRASSLAND BIOME STUDY - AN OVERVIEW. (VAN DYNE 1971)	SS10,1-10
ECOSYSTEM-STRESS	DECOMPOSER AND NITROGEN CYCLING INVESTIGATIONS IN THE GRASSLAND BIOME. (REUSS 1971)	SS10,133-146
ECOTYPE	THE NATURE AND SIGNIFICANCE OF ECO-GENETIC VARIATION IN ECOSYSTEMS. (WARD 1969)	SS02,148-152
ECOTYPE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS. BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
EFFICIENCY-ENERGY-CAPTURE	ENERGRY FIXATION AND THE ROLE OF PRIMARY PRODUCERS IN ENERGY FLUX OF GRASSLAND ECOSYS TEMS. (MOIR 1969)	SS02,125-147
EFFICIENCY-ENERGY-CAPTURE	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
EGESTION	METABOLIC COMPONENTS OF CATTLE UNDER LIGHT AND HEAVY RATES OF STOCKING IN 1970. (HYDER, ET. AL. 1971)	TR128
EGESTION	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
EGESTION	FUNCTIONAL INTERACTION OF LARGE HERBIVORES ON GRASSLANDS. (RICE, ET. AL. 1971)	SS10,241-266
EGESTION	BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF CATTLE AND SHEEP GRAZING SHORTGRASS P RAIRIE. (RICE AND VAVRA 1971)	TR103
EGESTION	METABOLIC COMPONENTS OF CATTLE: WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTITIONING BY CATTLE. (HYDER, ET. AL. 1969)	TR010
EGESTION	BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF STEERS GRAZING LIGHT, MEDIUM AND HEAV Y USE. (RICE AND VAVRA 1969)	AR69-2561.3
ELAND	FUNCTIONAL INTERACTION OF LARGE HERBIVORES ON GRASSLANDS. (RICE, ET. AL. 1971)	SS10,241-266
ENCHYTRAEIDS	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
ENERGY-BALANCE	MICROCLIMATE AND ITS IMPORTANCE IN GRASSLAND ECOSYSTEMS. (WHITMAN 1969)	SS02,40-64
ENERGY-BALANCE	DYNAMICS OF THE ATMOSPHERE IN THE GRASSLAND ECOSYSTEM. (POCHOP 1969)	SS02,89-100
ENERGY-BALANCE	ABIOTIC FACTORS IN GRASSLAND ECOSYSTEM ANALYSIS AND FUNCTION. (RASMUSSEN 1971)	SS10,11-34
ENERGY-BALANCE	FUNCTIONAL INTERACTION OF LARGE HERBIVORES ON GRASSLANDS. (RICE, ET. AL. 1971)	SS10,241-266
ENERGY-BALANCE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS. PROGRESS REPORT 1969-8.53 . (VAN DYNE 1969)	PR69-8.53
ENERGY-BALANCE	MEASUREMENT OF THE ENERGY STATUS OF WATER IN A GRASSLAND ECOSYSTEM. (VAN HAVEREN 1971)	TR076
ENERGY-FLOW	DATA COLLECTED ON THE PAWNEE SITE RELATING TO WESTERN HARVESTER ANT AND INSECT PREDAT ORS AND PARASITES, 1970. (LAVIGNE, ET. AL. 1971)	TR107
ENERGY-FLOW	PROGRESS REPORT IBP ANTELOPE PROJECT, PAWNEE SITE. (NAGY, ET. AL. 1969)	TR013
ENERGY-FLOW	THE MICROBIAL COMPONENT OF THE ECOSYSTEM. (CLARK 1970)	TR052
ENERGY-FLOW	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
ENERGY-FLOW	FUNCTIONAL INTERACTION OF LARGE HERBIVORES ON GRASSLANDS. (RICE, ET. AL. 1971)	SS10,241-266
ENERGY-FLOW	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
ENERGY-FLOW	PATTERN AND PROCESS IN GRASSLAND BIRD COMMUNITIES. (WIENS 1971)	SS10,147-212
ENERGY-FLOW	PRODUCER FUNCTION ON THE INTENSIVE AND COMPREHENSIVE SITES. (WILLIAMS 1971)	SS10,125-132
ENERGY-FLOW	THE ROLE OF CONSUMERS IN A GRASSLAND ECOSYSTEM. (PIEPER 1969)	SS02,316-329
ENERGY-FLOW	PRIMARY PRODUCERS IN GRASSLAND ECOSYSTEMS. (LEWIS 1970)	SS02S241,1-87
ENERGY-FLOW	IBP ANTELOPE PROJECT PROGRESS REPORT. (NAGY, ET. AL. 1969)	AR69-2561.4
ENERGY-FLOW	SUMMER ECOLOGY OF THE LARK-BUNTING IN NORTH-CENTRAL COLORADO. (CREIGHTON 1969)	AR69-2563.1
ENERGY-FLOW	ENERGY-FLUX AND WATER KINETICS IN YOUNG PRONGHORN ANTELOPE. (WESLEY, ET. AL. 1970)	OL040
EROSION	DYNAMICS OF MULCH LAYER IN GRASSLAND ECOSYSTEMS. (TOMANEK 1969)	SS02,225-240
EROSION	THE GRASSLAND HYDROLOGIC CYCLE. (STRIFFLER 1969)	SS02,101-116
EROSION	HYDROLOGY AND WATER BALANCE OF SEMI-DESERT SOILS. (COOPER 1970)	SS06I,119-128
EROSION	SOIL MOVEMENT IN A GRASSLAND ECOSYSTEM AS MEASURED BY BETA PARTICLE ATTENUATION. (ALLDREDGE AND WHICKER 1971)	TR065

KEY-WORD	ARTICLE	REFERENCE
EVAPORATION	MODELS FOR INFERRING EVAPORATION FROM METEOROLOGICAL MEASUREMENTS. (NUNN, ET. AL. 1970)	TR047
EVAPORATION	COMPREHENSIVE NETWORK SITE DESCRIPTION, PANTEX. (HUDDLESTON 1970)	TR045
EVAPORATION	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.53. (VAN DYNE 1969)	PR69-8.53
EVAPORATION	A QUANTITATIVE ECOLOGY OF THE JORNADA EXPERIMENTAL RANGE. (HERBEL, ET. AL. 1970)	SS06I,133-177
EVAPORATION	SOME ASPECTS OF THE ECOLOGICAL CLIMATOLOGY OF THE JORNADA EXPERIMENTAL RANGE NEW-MEXICO. (BRYSON, ET. AL. 1970)	SS06I,2-74
EVAPORATION	HYDROLOGY AND WATER BALANCE OF SEMI-DESERT SOILS. (COOPER 1970)	SS06I,119-128
EVAPORATION	ABIOTIC FACTORS IN GRASSLAND ECOSYSTEM ANALYSIS AND FUNCTION. (RASMUSSEN 1971)	SS10,11-34
EVAPORATION	MICROCLIMATE AND ITS IMPORTANCE IN GRASSLAND ECOSYSTEMS. (WHITMAN 1969)	SS02,40-64
EVAPORATION	SOME INFLUENCES OF VEGETATION STRUCTURE ON ENERGY-FLUX, WATER-FLUX, AND NUTRIENT-FLUX IN GRASSLAND ECOSYSTEMS. (KNIGHT 1969)	SS02,197-220
EVAPORATION-MODEL	MODELS FOR INFERRING EVAPORATION FROM METEOROLOGICAL MEASUREMENTS. (NUNN, ET. AL. 1970)	TR047
EVAPOTRANSPIRATION	SOIL WATER STUDY OF A SHORTGRASS PRAIRIE ECOSYSTEM, PAWNEE SITE. (GALBRAITH 1969)	TR006
EVAPOTRANSPIRATION	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
EVAPOTRANSPIRATION	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-6. (VAN DYNE 1969)	PR69-6.
EVAPOTRANSPIRATION	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
EVAPOTRANSPIRATION	THE GRASSLAND HYDROLOGIC CYCLE. (STRIFFLER 1969)	SS02,101-116
EVAPOTRANSPIRATION	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
EVAPOTRANSPIRATION	ABIOTIC FACTORS IN GRASSLAND ECOSYSTEM ANALYSIS AND FUNCTION. (RASMUSSEN 1971)	SS10,11-34
EVAPOTRANSPIRATION	CLIMATE-PLANT RELATIONS AFFECTING SEMI-DESERT GRASSLAND HYDROLOGY. (COLLINS 1970)	SS06I,100-118
EVAPOTRANSPIRATION	SOME ASPECTS OF THE ECOLOGICAL CLIMATOLOGY OF THE JORNADA EXPERIMENTAL RANGE NEW-MEXICO. (BRYSON, ET. AL. 1970)	SS06I,2-74
EXCRETION	METABOLIC COMPONENTS OF CATTLE UNDER LIGHT AND HEAVY RATES OF STOCKING IN 1970. (HYDER, ET. AL. 1971)	TR128
EXCRETION	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
EXCRETION	METABOLIC COMPONENTS OF CATTLE: WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTITIONING BY CATTLE. (HYDER, ET. AL. 1969)	TR010
EXCRETION	IBP ANTELOPE PROJECT PROGRESS REPORT. (NAGY, ET. AL. 1969)	AR69-2561.4
EXCRETION	WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTIONING BY CATTLE. (HYDER 1969)	AR69-2561.1
EXUDATE	THE MICROFLORA OF GRASSLAND. (CLARK AND PAUL 1970)	OL005
EXUDATE	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTIONS. (CLARK 1969)	SS02,361-376
FALCON	DIURNAL RAPTORS ON THE PAWNEE SITE. (RYDER 1969)	TR026
FALCON	AVIAN POPULATIONS AT THE PAWNEE SITE. (RYDER 1969)	AR69-2563.2
FEEDING-HABIT	SUMMER ECOLOGY OF THE LARK-BUNTING IN NORTH-CENTRAL COLORADO. (CREIGHTON 1969)	AR69-2563.1
FEEDING-HABIT	SOME COMPARISONS OF THE FEEDING ECOLOGY OF FOUR OWLS IN NORTH CENTRAL COLORADO. (MARTI 1969)	OL029
FEEDING-HABIT	SUMMER ECOLOGY OF THE LARK-BUNTING, PAWNEE SITE. (BALDWIN, ET. AL. 1969)	TR029
FEEDING-HABIT	AN ECOLOGICAL STUDY OF RODENTS IN A SHORTGRASS PRAIRIE OF NORTHEASTERN COLORADO. (FLAKE 1971)	TR100
FEEDING-HABIT	PROGRESS REPORT, WORK ON BIRD FEEDING AND NESTING BEHAVIOR AT THE PAWNEE SITE. (CREIGHTON 1971)	TR067
FEEDING-HABIT	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
FEEDING-HABIT	LIFE HISTORY, FOOD HABITS, HABITAT REQUIREMENTS, AND POPULATION DYNAMICS OF SMALL HERBIVORES ON SEMI-DESERT GRASSLANDS. (LAYCOCK 1970)	SS06I,198-212
FEEDING-HABIT	PATTERN AND PROCESS IN GRASSLAND BIRD COMMUNITIES. (WIENS 1971)	SS10,147-212
FERTILIZATION	HERBAGE DYNAMICS ON THE PAWNEE SITE: ABOVEGROUND AND BELOWGROUND HERBAGE DYNAMICS ON THE FOUR GRAZING INTENSITY TREATMENTS; AND PRELIMINARY SAMPLING ON THE ECOSYSTEM STRESS SITE. (SIMS, ET. AL. 1971)	TR099
FIELD-CAPACITY	HYDROLOGY AND WATER BALANCE OF SEMI-DESERT SOILS. (COOPER 1970)	SS06I,119-128
FIELD-DATA-PROCEDURES	STUDIES OF PRODUCER BIOMASS AT THE PAWNEE SITE. (SIMS 1970)	SS07,60-61

KEY-WORD	ARTICLE	REFERENCE
FIELD-DATA-PROCEDURES	USE OF ELECTRONIC METER IN ESTIMATING BIOMASS. (JAMESON 1970)	SS07,65
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GROUND-SQUIRREL	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
GROUND-SQUIRREL	RELATIVE DRY WEIGHT ESTIMATES IN DIETS OF HERBIVORES BY THE MICROSCOPIC METHOD, AND SMALL MAMMAL BIOMASS ESTIMATION AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	AR69-2562.1
GROUND-SQUIRREL-DENSITY	THE ROLE OF HERBIVOROUS MAMMALS IN THE FUNCTIONING OF THE GRASSLAND ECOSYSTEM. (GROSS 1969)	SS02,268-278
GROWING-SEASON	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124

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GROWTH-RATE	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
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HABITAT	PATTERN AND PROCESS IN GRASSLAND BIRD COMMUNITIES. (WIENS 1971)	SS10,147-212
HABITAT	HABITAT HETEROGENEITY AND THE STRUCTURE OF AVIAN COMMUNITIES IN GRASSLANDS. (WEINS 1970)	OL041
HAWK	AVIAN POPULATIONS AT THE PAWNEE SITE. (RYDER 1969)	AR69-2563.2
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INTERCEPTION	CLIMATE-PLANT RELATIONS AFFECTING SEMI-DESERT GRASSLAND HYDROLOGY. (COLLINS 1970)	SS06I,100-118

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INTERCEPTION	PRODUCER FUNCTION ON THE INTENSIVE AND COMPREHENSIVE SITES. (WILLIAMS 1971)	SS10,125-132
INTERCEPTION	THE GRASSLAND HYDROLOGIC CYCLE. (STRIFFLER 1969)	SS02,101-116
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MAMMAL-NUTRITION	BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF STEERS GRAZING LIGHT, MEDIUM AND HEAV Y USE. (RICE AND VAVRA 1969)	AR69-2561.3
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MEADOW-LARK-PRODUCTION	PATTERN AND PROCESS IN GRASSLAND BIRD COMMUNITIES. (WIENS 1971)	SS10,147-212
MEAN-PARTICLE-SIZE	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
METABOLIC-RATE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-4. (VAN DYNE 1969)	PR69-4.
METABOLIC-RATE	ASSIMILATION RATES OF SMALL MAMMAL HERBIVORES. (HANSEN AND CAVENDER 1970)	TR051
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METABOLIC-RATE	FUNCTIONAL INTERACTION OF LARGE HERBIVORES ON GRASSLANDS. (RICE, ET. AL. 1971)	SS10,241-266
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METABOLIC-RATE	IBP ANTELOPE PROJECT PROGRESS REPORT. (NAGY, ET. AL. 1969)	AR69-2561.4
METABOLIC-RATE	ENERGY-FLUX AND WATER KINETICS IN YOUNG PRONGHORN ANTELOPE. (WESLEY, ET. AL. 1970)	OL040
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METEOROLOGY	1970 METEOROLOGICAL DATA AVAILABILITY FOR THE PAWNEE SITE. (NUNN 1971)	TR097
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METEOROLOGY	IBP REPORT. (NUNN 1969)	AR69-2531.1
METEOROLOGY	ABIOTIC FACTORS IN GRASSLAND ECOSYSTEM ANALYSIS AND FUNCTION. (RASMUSSEN 1971)	SS10,11-34
METEOROLOGY	SOME ASPECTS OF THE ECOLOGICAL CLIMATOLOGY OF THE JORNADA EXPERIMENTAL RANGE NEW-MEXICO. (BRYSON, ET. AL. 1970)	SS06I,2-74
METEOROLOGY	METEOROLOGICAL CHARACTERISTICS OF HEAVILY AND LIGHTLY GRAZED NATURAL GRASS RANGE LAND. (NUNN, ET. AL. 1971)	OL015
MICRO-WATERSHEDS	HYDROLOGIC INVESTIGATIONS. (STRIFFLER 1969)	AR69-2541.1
MICRO-WATERSHEDS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
MICRO-WATERSHEDS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-4. (VAN DYNE 1969)	PR69-4.
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MICROBIAL-BIOMASS	MICROBIAL BIOMASS MEASUREMENTS AT THE PAWNEE SITE, PRELIMINARY METHODOLOGY AND RESULTS. (DOXTADER 1969)	AR69-2572.1
MICROBIAL-BIOMASS	DECOMPOSER AND NITROGEN CYCLING INVESTIGATIONS IN THE GRASSLAND BIOME. (REUSS 1971)	SS10,133-146
MICROBIAL-BIOMASS	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTIONS. (CLARK 1969)	SS02,361-376

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MICROBIAL-BIOMASS	BIOMASS DETERMINATIONS OF SOIL MICROORGANISMS. (DOXTADER 1970)	SS07,107-108
MICROBIAL-BIOMASS	MICROBIOLOGICAL STUDIES AT THE OSAGE SITE, 1970. (HARRIS 1971)	TR102
MICROBIAL-BIOMASS	MICROBIAL MEASUREMENTS AT THE PANTEX SITE, 1970. (BOULETTE, ET. AL. 1971)	TR095
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MICROBIAL-BIOMASS	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
MICROBIAL-DENSITY	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-4. (VAN DYNE 1969)	PR69-4.
MICROBIAL-DENSITY	DISTRIBUTION OF MICROORGANISMS IN PAWNEE SITE SOIL PROFILES. (MAYEUX AND JONES 1970)	SS07,112-120
MICROBIAL-DENSITY	BACTERIAL ECOLOGY OF PAWNEE GRASSLAND SOILS. (MAYEUX AND JONES 1969)	AR69-2572.2
MICROBIAL-DENSITY	MICROBIAL BIOMASS MEASUREMENTS AT THE PAWNEE SITE, PRELIMINARY METHODOLOGY AND RESULTS. (DOXTADER 1969)	AR69-2572.1
MICROBIAL-ENERGETICS	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
MICROBIAL-ENERGYFLOW	THE MICROBIAL COMPONENT OF THE ECOSYSTEM. (CLARK 1970)	TR052
MICROBIAL-HIERARCHIAL-DIAGRAM	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.4. (VAN DYNE 1970)	PR70-2.4
MICROBIAL-POPULATION	BACTERIAL ECOLOGY OF GRASSLAND SOILS, PAWNEE SITE. (MAYEUX AND JONES 1969)	TR022
MICROBIAL-POPULATION	SOIL MICROFUNGI INVESTIGATIONS, PAWNEE SITE. (CHRISTENSEN,SCARBOROUGH 1969)	TR023
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MICROBIAL-POPULATION	BACTERIAL ECOLOGY OF PAWNEE GRASSLAND SOILS. (MAYEUX AND JONES 1969)	AR69-2572.2
MICROBIAL-POPULATION	MICROBIAL BIOMASS MEASUREMENTS AT THE PAWNEE SITE, PRELIMINARY METHODOLOGY AND RESULTS. (DOXTADER 1969)	AR69-2572.1
MICROCLIMATE	MICROCLIMATE AND ITS IMPORTANCE IN GRASSLAND ECOSYSTEMS. (WHITMAN 1969)	SS02,40-64
MICROCLIMATE	THE ROLE OF ABIOTIC FACTORS IN THE STRUCTURE AND FUNCTION OF THE GRASSLAND ECOSYSTEM. (BURZLAFF 1969)	SS02,117-123
MICROCLIMATE	A QUANTITATIVE ECOLOGY OF THE JORNADA EXPERIMENTAL RANGE. (HERBEL, ET. AL. 1970)	SS06I,133-177
MICROCLIMATE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.53. (VAN DYNE 1969)	PR69-8.53
MICROCLIMATE	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
MICROFLORA	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
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MICROFLORA	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTIONS. (CLARK 1969)	SS02,361-376
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MICROFLORA	MICROBIAL BIOMASS MEASUREMENTS AT THE PAWNEE SITE, PRELIMINARY METHODOLOGY AND RESULTS. (DOXTADER 1969)	AR69-2572.1
MICROFLORA	THE MICROFLORA OF GRASSLAND. (CLARK AND PAUL 1970)	OL005
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MINERALISATION	NITROGEN IN GRASSLAND ECOSYSTEMS. (PORTER 1969)	SS02,377-402
MITE	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
MODELLING-CONCEPT	GRASSLANDS MANAGEMENT, RESEARCH, AND TRAINING VIEWED IN A SYSTEMS CONTEXT. (VAN DYNE 1969)	SS03,1-39

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MODELLING-CONCEPT	STRUCTURE OF ECOSYSTEM STUDIES ON AN INTERNATIONAL BASIS. (VAN DYNE 1970)	SS07,45-46
MODELLING-CONCEPT	INTRODUCTION. (VAN DYNE 1970)	SS07,176-178
MODELLING-CONCEPT	BASIC CONCEPTS IN MATHEMATICAL MODELLING OF GRASSLAND ECOSYSTEMS. (JAMESON 1970)	SS05,1-15
MODELLING-CONCEPT	MODELS AND SELECTION OF EXPERIMENTS. (JAMESON AND BLEDSOE 1970)	SS05,111-134
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MODELLING-CONCEPT	SIMCOMP VERSION 2.0 USERS MANUAL. (GUSTAFSON AND INNIS 1972)	TR138
MODELLING-CONCEPT	SOME MATHEMATICAL MODELS OF GRASSLAND ECOSYSTEMS. (VAN DYNE 1969)	SS02,3-26
MODELLING-CONCEPT	THE U.S. IBP GRASSLAND BIOME STUDY - AN OVERVIEW. (VAN DYNE 1971)	SS10,1-10
MODELLING-CONCEPT	MODELLING THE GROWTH OF PLANTS IN SEMI-ARID GRASSLAND. (GOODALL 1970)	SS06I,129-132
MODELLING-CONCEPT	A GUIDE TO MATHEMATICAL MODELLING OF AN ECOSYSTEM. (CLYMER AND BLEDSOE 1970)	SS06I,75-99
MODELLING-CONCEPT	STOCHASTIC ABILITY AND SECONDARY SUCCESSION. (JAMESON 1970)	SS06I,191-197
MODELLING-CONCEPT	SOME CONCEPTS OF MODELLING. (SWARTZMAN, ET. AL. 1970)	TR032
MODELLING-CONCEPT	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.51 . (VAN DYNE 1969)	PR69-8.51
MODELLING-CONCEPT	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.4. (VAN DYNE 1971)	PR71-2.4
MODELLING-CONCEPT	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-4.1. (VAN DYNE 1970)	PR70-4.1
MODELLING-CONCEPT	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-6. (VAN DYNE 1969)	PR69-6.
MODELLING-CONCEPT	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
MODELLING-CONCEPT	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-0. (VAN DYNE 1969)	PR69-0
MODELLING-CONCEPT	A COMPARTMENT MODEL SIMULATION OF SECONDARY SUCCESSION. (BLEDSOE AND VAN DYNE 1971)	OL010
MODELLING-CONCEPT	LAND MANAGEMENT POLICY AND DEVELOPMENT OF ECOLOGICAL CONCEPTS. (JAMESON 1970)	OL027
MODELLING-CONCEPT	MODELS OF SEASONAL PRIMARY PRODUCTIVITY IN EASTERN TENNESSEE FESTUCA AND ANDROPOGON E COSYSTEMS. (KELLY, ET. AL. 1969)	OL028
MODELLING-CONCEPT	SYSTEMS ECOLOGY. (VAN DYNE 1970)	OL035
MODELLING-CONCEPT	SOME ANALYTICAL AND OPERATIONAL APPROACHES TO DEVELOPING DYNAMICMODELS OF ECOLOGICAL SYSTEMS. (VAN DYNE, ET. AL. 1971)	OL019
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MODELLING-CONCEPT	A SYSTEMS APPROACH TO GRASSLANDS. (VAN DYNE 1970)	OL034
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MODELLING-CONCEPT	OPTIMIZATION APPROACHES TO OPERATIONAL GRASSLAND ECOSYSTEM MANAGEMENT. (SWARTZMAN 1971)	OL017
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MODELS	OPTIMIZATION APPROACHES TO OPERATIONAL GRASSLAND ECOSYSTEM MANAGEMENT. (SWARTZMAN 1971)	OL017
MODELS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-0. (VAN DYNE 1969)	PR69-0
MODELS	FUNCTIONAL INTERACTION OF LARGE HERBIVORES ON GRASSLANDS. (RICE, ET. AL. 1971)	SS10,241-266
MODELS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
MODELS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-6. (VAN DYNE 1969)	PR69-6.
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MODELS	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.4. (VAN DYNE 1971)	PR71-2.4
MODELS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.51 . (VAN DYNE 1969)	PR69-8.51
MODELS	SOME CONCEPTS OF MODELLING. (SWARTZMAN, ET. AL. 1970)	TR032
MODELS	MODELS FOR INFERRING EVAPORATION FROM METEOROLOGICAL MEASUREMENTS. (NUNN, ET. AL. 1970)	TR047
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NITROGEN-FIXATION	SOIL NITROGEN INVESTIGATIONS, PAWNEE SITE. (REUSS AND COPLEY 1969)	TR007
NITROGEN-FIXATION	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS. BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
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NITROGEN-FIXATION	THE MICROFLORA OF GRASSLAND. (CLARK AND PAUL 1970)	OL005
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OSAGE	ABIOTIC FACTORS IN GRASSLAND ECOSYSTEM ANALYSIS AND FUNCTION. (RASMUSSEN 1971)	SS10,11-34
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PANTEX	INSECT POPULATION STUDIES. (HUDDLESTON, ET. AL. 1971)	TR079
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PARASITES	CLOSTRIDIUM PERFRINGENS ENTEROTOXEMIA IN HARD REARED ANTELOPE. (NAGY, ET. AL. 1969)	OL001
PAWNEE	BACTERIAL ECOLOGY OF PAWNEE GRASSLAND SOILS. (MAYEUX AND JONES 1969)	AR69-2572.2
PAWNEE	THE FEEDING REGIME OF GRANIVOROUS BIRDS IN SHORTGRASS PRAIRIE OF COLORADO. (BALDWIN 1970)	OL021
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PAWNEE	ENTOMOLOGICAL PROJECT 7103, GRASSLAND BIOME. (THATCHER 1969)	AR69-2564.2
PAWNEE	THE EFFECT OF INSECT PREDATORS AND PARASITES ON GRASS FEEDING INSECTS. (LAVIGNE 1969)	AR69-2564.3
PAWNEE	DIETS AND ENERGY RELATIONS OF JACKRABBITS AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	AR69-2562
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PAWNEE	PROPOSAL FOR A CELLULOSE DECOMPOSITION STUDY AT THE PAWNEE SITE. (CLARK 1969)	AR69-2572.3
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PAWNEE	AVIAN POPULATIONS AT THE PAWNEE SITE. (RYDER 1969)	AR69-2563.2
PAWNEE	PRELIMINARY REPORT ON THE PROGRESS OF THE BISON STUDIES. (PEDEN 1969)	AR69-2562.4
PAWNEE	OPUNTIA CLUMP SIZE VARIATION ON THE SHORTGRASS PLAINS, PAWNEE SITE, NUNN, COLORADO. (LESTER AND FISSER 1970)	OL014
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PAWNEE	SOIL MACRO-ARTHROPOD SPECIES AND THEIR DISTRIBUTION AND ABUNDANCE IN THE GRASSLAND BI OME. (LLOYD 1969)	AR69-2571.1
PAWNEE	A PRELIMINARY STUDY OF LENTIC COMMUNITIES ON THE PAWNEE NATIONAL GRASSLANDS. (LAVELLE, ET. AL. 1969)	AR69-2581-82
PAWNEE	AVIAN DISTRIBUTION AND POPULATION FLUCTUATIONS, PAWNEE SITE. (GIEZENTANNER AND RYDER 1969)	TR028
PAWNEE	PROGRESS REPORT IBP ANTELOPE PROJECT, PAWNEE SITE. (NAGY, ET. AL. 1969)	TR013

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PAWNEE	SUMMER ECOLOGY OF THE LARK-BUNTING, PAWNEE SITE. (BALDWIN, ET. AL. 1969)	TR029
PAWNEE	DIETARY AND ENERGY RELATIONSHIPS OF JACKRABBITS AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	TR014
PAWNEE	SOIL MICROFUNGI INVESTIGATIONS, PAWNEE SITE. (CHRISTENSEN,SCARBOROUGH 1969)	TR023
PAWNEE	JACKRABBIT DEMOGRAPHIC AND LIFE HISTORY STUDIES, PAWNEE SITE. (GROSS 1969)	TR016
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PAWNEE	THE MICROSCOPE METHOD USED FOR HERBIVORE DIET ESTIMATES AND BOTANICAL ANALYSIS OF LIT TER AND MULCH AT THE PAWNEE SITE. (CAVENDER AND HANSEN 1970)	TR018
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PAWNEE	GENERAL DESCRIPTION OF THE PAWNEE SITE. (JAMESON, ET. AL. 1969)	TR001
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PAWNEE	SUMMARY REPORT ON INITIAL SMALL-HERBIVOROUS-MAMMAL MODELING EFFORTS. (GROSS AND WALTERS 1970)	TR004
PAWNEE	PAWNEE SITE MICROWATERSHEDS: SELECTION DESCRIPTION AND INSTRUMENTATION. (SMITH AND STRIFFLER 1969)	TR005
PAWNEE	SOIL WATER STUDY OF A SHORTGRASS PRAIRIE ECOSYSTEM, PAWNEE SITE. (GALBRAITH 1969)	TR006
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PAWNEE	IDENTIFICATION OF INSECTS AND DENSITY DETERMINATIONS OF THE STOMACH CONTENTS OF SMALL MAMMALS. (CWIK 1970)	TR053
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PAWNEE	AVIAN POPULATIONS AND PATTERNS OF HABITAT OCCUPANCY AT THE PAWNEE SITE, 1968-1969. (WEINS 1970)	TR063
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PAWNEE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.5. (VAN DYNE 1970)	PR70-2.5
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PAWNEE	REPLACEMENT OF NATIVE COMMUNITIES WITH INTRODUCED COMMUNITIES AND ITS IMPACT ON ECOSYSTEM FUNCTION. (EVERSON 1969)	AR69-2552.2
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PAWNEE	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
PAWNEE-MODEL	PWNEE: A GRASSLAND ECOSYSTEM MODEL. (BLEDSOE, ET. AL. 1971)	TR064
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PERSONNEL-VITAE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
PHENOLOGY	PRIMARY PRODUCTIVITY OF THE FESCUE GRASSLAND IN WESTERN MONTANA. (MORRIS AND BRUNNER 1971)	TR113
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PHENOLOGY	SEASONAL CARBOHYDRATE RESERVE CYCLES IN EIGHT DESERT RANGE SPECIES. (COYNE AND COOK 1970)	OL023
PHOTOSYNTHESIS	PRODUCER FUNCTION ON THE INTENSIVE AND COMPREHENSIVE SITES. (WILLIAMS 1971)	SS10,125-132
PHOTOSYNTHESIS	PRIMARY PRODUCERS IN GRASSLAND ECOSYSTEMS. (LEWIS 1970)	SS02S241,1-87
PHOTOSYNTHESIS	A PHOTOSYNTHESIS MEASUREMENT SYSTEM FOR THE PAWNEE SITE. (MOIR 1970)	SS07,151-154
PHOTOSYNTHESIS	SOME INFLUENCES OF VEGETATION STRUCTURE ON ENERGY-FLUX, WATER-FLUX, AND NUTRIENT-FLUX IN GRASSLAND ECOSYSTEMS. (KNIGHT 1969)	SS02,197-220

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PHOTOSYNTHESIS	ENERGRY FIXATION AND THE ROLE OF PRIMARY PRODUCERS IN ENERGY FLUX OF GRASSLAND ECOSYS TEMS. (MOIP 1969)	SS02,125-147
PHOTOSYNTHESIS	GROWTH OF BOUTELOUA GRACILIS IN A BIOSYNTHESIS CHAMBER. (GREEN AND COLE 1971)	TR069
PHOTOSYNTHESIS	PHOTOSYNTHESIS OF SHORTGRASSES UNDER FIELD CONDITIONS. (MOIR, ET. AL. 1969)	TR031
PHOTOSYNTHESIS	CO2 EXCHANGE OVER SHORTGRASS SODS. (DYE AND MOIR 1971)	TR081
PHOTOSYNTHESIS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-6. (VAN DYNE 1969)	PR69-6.
PHOTOSYNTHESIS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
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PHOTOSYNTHESIS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.5. (VAN DYNE 1970)	PR70-2.5
PHOTOSYNTHESIS	PHOTOSYNTHESIS OF SHORTGRASSES UNDER FIELD CONDITIONS. (MOIR 1969)	AR69-2551.1
PHYTOPLANKTON	AQUATIC PRIMARY PRODUCTIVITY AND PHYSICAL-CHEMICAL LIMNOLOGY ON THE PAWNEE SITE. (HERRMANN, ET. AL. 1970)	TR049
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PLANT-CHECKLIST	COMPREHENSIVE NETWORK SITE DESCRIPTION, COTTONWOOD. (LEWIS 1970)	TR039
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PLANT-CHECKLIST	TAXONOMIC SUPPORT FOR THE GRASSLAND BIOME STUDY. (KLEIN 1969)	AR69-2510
PLANT-CHECKLIST	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-4. (VAN DYNE 1969)	PR69-4.
PLANT-CHECKLIST	THE IMPACT OF DOMESTIC ANIMALS ON THE FUNCTION AND STRUCTURE OF GRASSLAND ECOSYSTEMS. (HYDER 1969)	SS02,243-260
PLANT-CHECKLIST	COMPARISONS OF ABOVEGROUND PLANT BIOMASS ON UNGRAZED PASTURES VS. PASTURES GRAZED BY LARGE HERBIVORES, 1970 SEASON. (GRANT 1971)	TR131
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PLANT-COMPETITION	THE NATURE AND IMPORTANCE OF COMPETITION BETWEEN WOODY AND HERBACEOUS PLANTS IN A GRA SSLAND ECOSYSTEM. (SHUBERT 1969)	SS02,172-182
PLANT-COMPETITION	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.52 . (VAN DYNE 1969)	PR69-8.52
PLANT-COMPETITION	COMPETITIVE RELATIONSHIPS AMONG HERBACEOUS GRASSLAND PLANTS. (RISSER 1969)	OL031
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PLANT-COVER	A FIELD LIGHT QUALITY LABORATORY--INITIAL EXPERIMENT: THE MEASUREMENT OF PERCENT OF FUNCTIONING VEGETATION IN GRASSLAND AREAS BY REMOTE SENSING METHODOLOGY. (PEARSON, ET. AL. 1971)	TR090
PLANT-COVER	PRELIMINARY REPORT OF METHODOLOGY AND RESULTS FOR ANALYSIS OF PLANT PATTERN SUBPROJEC T RESEARCH ON THE PAWNEE SITE. (FISSER 1969)	TR009
PLANT-COVER	SOME MEASUREMENTS OF VEGETATION STRUCTURE ON THE PAWNEE GRASSLAND, 1970. (KNIGHT 1971)	TR072
PLANT-COVER	SOME INFLUENCES OF VEGETATION STRUCTURE ON ENERGY-FLUX, WATER-FLUX, AND NUTRIENT-FLUX IN GRASSLAND ECOSYSTEMS. (KNIGHT 1969)	SS02,197-220
PLANT-COVER	PSYCHROMETRY IN WATER RELATIONS RESEARCH: A REVIEW. (VAN HAVEREN 1971)	TR132
PLANT-COVER	A QUANTITATIVE ECOLOGY OF THE JORNADA EXPERIMENTAL RANGE. (HERBEL, ET. AL. 1970)	SS061,133-177
PLANT-DIVERSITY	PLANT COMMUNITY STRUCTURE. (RISSER 1971)	SS10,41-58
PLANT-ENERGETICS	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124

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PLANT-ENERGETICS	PRIMARY PRODUCERS IN GRASSLAND ECOSYSTEMS. (LEWIS 1970)	SS02S241,1-87
PLANT-FRAGMENT-IDENTIFICATION	DRAWINGS OF TISSUES OF PLANTS FOUND IN HERBIVORE DIETS AND IN THE LITTER OF GRASSLANDS. (HANSEN, ET. AL. 1971)	TR070
PLANT-FRAGMENT-IDENTIFICATION	THE MICROSCOPE METHOD USED FOR HERBIVORE DIET ESTIMATES AND BOTANICAL ANALYSIS OF LITTER AND MULCH AT THE PAWNEE SITE. (CAVENDER AND HANSEN 1970)	TR018
PLANT-GROWTH	HERBAGE GROWTH RATE, FORAGE INTAKE, AND FORAGE QUALITY IN 1970 ON HEAVILY AND LIGHTLY GRAZED BLUE GRAMA PASTURES. (DYCK AND BEMENT 1971)	TR094
PLANT-GROWTH	PRELIMINARY RESULTS OF GROWTH CHARACTERISTICS OF BUFFALOGRASS, BLUE GRAMA, AND WESTERN WHEATGRASS, AND METHODOLOGY FOR TRANSLOCATION STUDIES USING 14C AS A TRACER. (KNIEVEL AND SCHMER 1971)	TR086
PLANT-GROWTH	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.4. (VAN DYNE 1971)	PR71-2.4
PLANT-GROWTH	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
PLANT-GROWTH	THE IMPACT OF DOMESTIC ANIMALS ON THE FUNCTION AND STRUCTURE OF GRASSLAND ECOSYSTEMS. (HYDER 1969)	SS02,243-260
PLANT-GROWTH	ENERGY FIXATION AND THE ROLE OF PRIMARY PRODUCERS IN ENERGY FLUX OF GRASSLAND ECOSYSTEMS. (MOIR 1969)	SS02,125-147
PLANT-GROWTH	PRODUCER FUNCTION ON THE INTENSIVE AND COMPREHENSIVE SITES. (WILLIAMS 1971)	SS10,125-132
PLANT-GROWTH	A QUANTITATIVE ECOLOGY OF THE JORNADA EXPERIMENTAL RANGE. (HERBEL, ET. AL. 1970)	SS06I,133-177
PLANT-GROWTH	MODELLING THE GROWTH OF PLANTS IN SEMI-ARID GRASSLAND. (GOODALL 1970)	SS06I,129-132
PLANT-GROWTH-MODEL	MODELLING THE GROWTH OF PLANTS IN SEMI-ARID GRASSLAND. (GOODALL 1970)	SS06I,129-132
PLANT-NUTRIENTS	RECIPROCAL INFLUENCES BETWEEN DOMESTIC ANIMALS AND OTHER COMPONENTS OF SEMI-DESERT ECOSYSTEMS. (HOUSTON 1970)	SS06I,178-190
PLANT-NUTRIENTS	SOIL CHEMISTRY AS A FACTOR IN THE FUNCTION OF GRASSLAND ECOSYSTEMS. (KLINE 1969)	SS02,71-88
PLANT-NUTRIENTS	THE MOBILITY AND TRANSLOCATION OF NITROGEN IN GRASS PLANTS. (PORTER 1969)	AR69-2552.3
PLANT-NUTRIENTS	SEASONAL CARBOHYDRATE RESERVE CYCLES IN EIGHT DESERT RANGE SPECIES. (COYNE AND COOK 1970)	OL023
PLANT-NUTRITION	PRIMARY PRODUCERS IN GRASSLAND ECOSYSTEMS. (LEWIS 1970)	SS02S241,1-87
PLANT-PATTERN	PRIMARY PRODUCERS IN GRASSLAND ECOSYSTEMS. (LEWIS 1970)	SS02S241,1-87
PLANT-PATTERN	PLANT PATTERN AND DISTRIBUTION IN ECOSYSTEMS AND RELATIONSHIPS TO FUNCTION. (FISSER 1969)	SS02,183-196
PLANT-PATTERN	PLANT COMMUNITY STRUCTURE. (RISSER 1971)	SS10,41-58
PLANT-PATTERN	ANALYSIS OF PLANT PATTERN, DISTRIBUTION AND RELATIONSHIP TO ENVIRONMENTAL PROCESSES. (FISSER AND LESHER 1969)	AR69-2553.1
PLANT-PATTERN	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
PLANT-PATTERN	SPATIAL DISTRIBUTION AND SUCCESSIONAL STATE OF GRASSLAND VEGETATION RELATED TO GRAZING INTENSITY TREATMENTS. (MITCHELL 1971)	TR101
PLANT-PATTERN	PRELIMINARY REPORT OF METHODOLOGY AND RESULTS FOR ANALYSIS OF PLANT PATTERN SUBPROJECT RESEARCH ON THE PAWNEE SITE. (FISSER 1969)	TR009
PLANT-PATTERN	OPUNTIA CLUMP SIZE VARIATION ON THE SHORTGRASS PLAINS, PAWNEE SITE, NUNN, COLORADO. (LESTER AND FISSER 1970)	OL014
PLANT-RESPIRATION	GROWTH OF BOUTELOUA GRACILIS IN A BIOSYNTHESIS CHAMBER. (GREEN AND COLE 1971)	TR069
PLANT-RESPIRATION	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
PLANT-RESPIRATION	PRODUCER FUNCTION ON THE INTENSIVE AND COMPREHENSIVE SITES. (WILLIAMS 1971)	SS10,125-132
PLANT-RESPIRATION	THE NATURE AND SIGNIFICANCE OF ECO-GENETIC VARIATION IN ECOSYSTEMS. (WARD 1969)	SS02,148-152
PLANT-RESPIRATION	PRIMARY PRODUCERS IN GRASSLAND ECOSYSTEMS. (LEWIS 1970)	SS02S241,1-87
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POCKET-GOPHER	A STUDY OF RODENTS IN NORTHEASTERN COLORADO. (FLAKE, 1969)	TR015
POCKET-GOPHER	SMALL MAMMAL SURVEY ON THE BISON, BRIDGER, COTTONWOOD, DICKINSON, AND OSAGE SITES. (HOFFMANN, ET. AL. 1971)	TR109
POCKET-GOPHER	THE ROLE OF HERBIVOROUS MAMMALS IN THE FUNCTIONING OF THE GRASSLAND ECOSYSTEM. (GROSS 1969)	SS02,268-278
POCKET-GOPHER-DENSITY	THE ROLE OF HERBIVOROUS MAMMALS IN THE FUNCTIONING OF THE GRASSLAND ECOSYSTEM. (GROSS 1969)	SS02,268-278
POCKET-MOUSE	SMALL MAMMAL SURVEY ON THE JORNADA AND PANTEX SITES. (PACKARD 1971)	TR114

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POND-CHEMICAL-CHARACTERISTICS	PHYSICAL AND CHEMICAL LIMNOLOGY OF COTTONWOOD POND AND SPRING POND (SEPT. 1969--DEC. 1970). (HERRMANN 1971)	TR071
POND-CHEMICAL-CHARACTERISTICS	AQUATIC PRIMARY PRODUCTIVITY AND PHYSICAL-CHEMICAL LIMNOLOGY ON THE PAWNEE SITE. (HERRMANN, ET. AL. 1970)	TR049
POND-CHEMICAL-CHARACTERISTICS	A PRELIMINARY STUDY OF THREE LENTIC COMMUNITIES ON THE PAWNEE NATIONAL GRASSLANDS. (LAVELLE, ET. AL. 1969)	SS02,308-315
POND-CHEMICAL-CHARACTERISTICS	A PRELIMINARY STUDY OF LENTIC COMMUNITIES ON THE PAWNEE NATIONAL GRASSLANDS. (LAVELLE, ET. AL. 1969)	AR69-2581-82
POND-PHYSICAL-CHARACTERISTICS	A PRELIMINARY STUDY OF LENTIC COMMUNITIES ON THE PAWNEE NATIONAL GRASSLANDS. (LAVELLE, ET. AL. 1969)	AR69-2581-82
POND-PHYSICAL-CHARACTERISTICS	A PRELIMINARY STUDY OF THREE LENTIC COMMUNITIES ON THE PAWNEE NATIONAL GRASSLANDS. (LAVELLE, ET. AL. 1969)	SS02,308-315
POND-PHYSICAL-CHARACTERISTICS	PHYSICAL AND CHEMICAL LIMNOLOGY OF COTTONWOOD POND AND SPRING POND (SEPT. 1969--DEC. 1970). (HERRMANN 1971)	TR071
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PONDS	PHYSICAL AND CHEMICAL LIMNOLOGY OF COTTONWOOD POND AND SPRING POND (SEPT. 1969--DEC. 1970). (HERRMANN 1971)	TR071
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POTENTIAL-EVAPORATION	RESULTS OF WORKSHOP GROUPS. (WRIGHT AND VAN DYNE 1970)	SS06II,1-69
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RUNOFF	HYDROLOGIC INVESTIGATIONS. (STRIFFLER 1969)	AR69-2541.1
RUNOFF	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
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SITE-DESCRIPTION	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
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SITE-DESCRIPTION	THE U.S. IBP GRASSLAND BIOME STUDY - AN OVERVIEW. (VAN DYNE 1971)	SS10,1-10
SITE-PHENOLOGY	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.6. (VAN DYNE 1970)	PR70-2.6
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SOIL-CHEMICAL-CHARACTERISTICS	THE ROLE OF ABIOTIC FACTORS IN THE STRUCTURE AND FUNCTION OF THE GRASSLAND ECOSYSTEM. (BURZLAFF 1969)	SS02,117-123
SOIL-CHEMICAL-CHARACTERISTICS	SOIL CHEMISTRY AS A FACTOR IN THE FUNCTION OF GRASSLAND ECOSYSTEMS. (KLINE 1969)	SS02,71-88
SOIL-DEPTH	SOILS OF THE GRASSLAND BIOME SITES. (REUSS 1971)	SS10,35-40
SOIL-FAUNA	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
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SOIL-FAUNA-POPULATION	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
SOIL-HEAT-FLUX	PRIMARY PRODUCTIVITY AND ABIOTIC STUDIES AT THE DICKINSON SITE. 1970 SEASON. (WHITMAN 1971)	TR116
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SOIL-NITROGEN	SOIL NITROGEN STUDIES. (REUSS 1969)	AR69-2542.1
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SOIL-PHYSICAL-CHARACTERISTICS	SOIL PHYSICAL CONDITIONS AFTER PLOWING AND PACKING OF RIDGES. (HYDER AND BEMENT 1970)	OL026
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SOIL-RESPIRATION	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS. PROGRESS REPORT 1970-2.5. (VAN DYNE 1970)	PR70-2.5
SOIL-RESPIRATION	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.7. (VAN DYNE 1971)	PR71-2.7
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SOIL-TEMPERATURE	THE IMPACT OF DOMESTIC ANIMALS ON THE FUNCTION AND STRUCTURE OF GRASSLAND ECOSYSTEMS. (HYDER 1969)	SS02,243-260
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SOIL-TEMPERATURE	METEOROLOGICAL DATA ACQUISITION SYSTEM, SEPTEMBER 1, 1970 - DECEMBER 31, 1970. (NUNN, ET. AL. 1971)	TR073
SOIL-TEMPERATURE	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
SOIL-TEMPERATURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.53. (VAN DYNE 1969)	PR69-8.53
SOIL-TEMPERATURE	METEOROLOGICAL CHARACTERISTICS OF HEAVILY AND LIGHTLY GRAZED NATURAL GRASS RANGE LAND. (NUNN, ET. AL. 1971)	OL015
SOIL-TYPES	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.5. (VAN DYNE 1970)	PR70-2.5
SOIL-TYPES	MINERALOGY OF REPRESENTATIVE SOILS. (FRANKLIN 1969)	AR69-2542.2
SOIL-TYPES	COMPREHENSIVE NETWORK SITE DESCRIPTION, BISON. (MORRIS 1970)	TR037
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SOIL-TYPES	THE DESIGN OF A SPATIAL DATA FRAMEWORK, CENTRAL BASIN WATERSHED, PAWNEE SITE. (OLIVER AND MILLER 1971)	TR089
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SOIL-WATER	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.4. (VAN DYNE 1971)	PR71-2.4
SOIL-WATER	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
SOIL-WATER	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.5. (VAN DYNE 1970)	PR70-2.5
SOIL-WATER	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.53. (VAN DYNE 1969)	PR69-8.53
SOIL-WATER	METEOROLOGICAL CHARACTERISTICS OF HEAVILY AND LIGHTLY GRAZED NATURAL GRASS RANGE LAND. (NUNN, ET. AL. 1971)	OL015

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SOIL-WATEP-HIERARCHIAL-DIAGRAM	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.4. (VAN DYNE 1970)	PR70-2.4
SOLAR-RADIATION	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION. 1970. (LEWIS 1971)	SS10,317-387
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AMPHIBIANS	THE IMPORTANCE AND ROLE OF AMPHIBIANS AND REPTILES IN GRASSLAND ECOSYSTEMS. (THOMAS 1970)	SS02S307,1-23
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ANTELOPE	WATER KINETICS IN PRONGHORN ANTELOPE. (WESLEY, ET. AL. 1969)	OL007
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ANTELOPE	CLOSTRIDIUM PERFRINGENS ENTEROTOXEMIA IN HARD REARED ANTELOPE. (NAGY, ET. AL. 1969)	OL001
ANTELOPE	WATER KINETICS IN PRONGHORN ANTELOPE. (WESLEY, ET. AL. 1969)	OL039
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BIRD	PROGRESS REPORT, WORK ON BIRD FEEDING AND NESTING BEHAVIOR AT THE PAWNEE SITE. (CREIGHTON 1971)	TR067
BIRD	A PRELIMINARY BIRD POPULATION DYNAMICS AND BIOMASS MODEL. (SWARTZMAN 1969)	TR003
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BISON	COMPREHENSIVE NETWORK SITE DESCRIPTION, BISON. (MORRIS 1970)	TR037
BISON	PRELIMINARY REPORT ON THE PROGRESS OF THE BISON STUDIES. (PEDEN 1969)	AR69-2562.4
BOTANICAL	BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF STEERS GRAZING LIGHT, MEDIUM AND HEAVY USE. (RICE AND VAVRA 1969)	AR69-2561.3
BOTANICAL	A COMPARISON OF THE ESOPHAGEAL OR RUMEN GRAB SAMPLING FOR THE BOTANICAL AND CHEMICAL DETERMINATION OF GRAZING SHEEP. (RICE AND CUNDY 1969)	AR69-2561.2
BOTANICAL	ESOPHAGEAL VS. FECAL SAMPLING FOR THE BOTANICAL DETERMINATION OF STEER DIETS. (VAVRA, ET. AL. 1970)	OL037
BOTANICAL	A COMPARISON OF THE ESOPHAGEAL FISTULA WITH RUMEN SAMPLES FOR THE DETERMINATION OF THE BOTANICAL AND CHEMICAL COMPOSITION OF THE DIET OF HERBIVORES. (RICE, ET. AL. 1969)	TR011
BOTANICAL	BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF STEERS GRAZING LIGHT, MEDIUM, AND HEAVY USE SHORTGRASS RANGE. (RICE AND VAVRA 1969)	TR012
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BOTANICAL	BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF CATTLE AND SHEEP GRAZING SHORTGRASS PRAIRIE. (RICE AND VAVRA 1971)	TR103
BOUTELOUA	GROWTH OF BOUTELOUA GRACILIS IN A BIOSYNTHESIS CHAMBER. (GREEN AND COLE 1971)	TR069
BRIDGER	COMPREHENSIVE NETWORK SITE DESCRIPTION, BRIDGER. (COLLINS 1970)	TR038
BRIDGER	THE BRIDGER SITE, 1970 PROGRESS REPORT. (COLLINS 1971)	TR084
BRIDGER	SMALL MAMMAL SURVEY ON THE BISON, BRIDGER, COTTONWOOD, DICKINSON, AND OSAGE SITES. (HOFFMANN, ET. AL. 1971)	TR109
BUDGET	IBP GRASSLANDS BIOME BUDGET PROGRAM. (ROBINSON 1970)	TR025
BUFFALOGRASS	PRELIMINARY RESULTS OF GROWTH CHARACTERISTICS OF BUFFALOGRASS, BLUE GRAMA, AND WESTERN WHEATGRASS, AND METHODOLOGY FOR TRANSLOCATION STUDIES USING 14C AS A TRACER. (KNIEVEL AND SCHMER 1971)	TR086
CARABIDAE	CARABIDAE (GROUND BEETLES). (BELL 1971)	TR066
CARBOHYDRATE	SEASONAL CARBOHYDRATE RESERVE CYCLES IN EIGHT DESERT RANGE SPECIES. (COYNE AND COOK 1970)	OL023
CATTLE	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMED BY GRAZING CATTLE. (WALLACE AND VAN DYNE 1970)	OL038
CATTLE	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMED BY GRAZING CATTLE. (WALLACE AND VAN DYNE 1970)	OL006
CATTLE	WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTIONING BY CATTLE. (HYDER 1969)	AR69-2561.1
CATTLE	METABOLIC COMPONENTS OF CATTLE: WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTITIONING BY CATTLE. (HYDER, ET. AL. 1969)	TR010
CATTLE	METABOLIC COMPONENTS OF CATTLE: WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTITIONING BY CATTLE. (HYDER, ET. AL. 1969)	TR010
CATTLE	BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF CATTLE AND SHEEP GRAZING SHORTGRASS PRAIRIE. (RICE AND VAVRA 1971)	TR103
CATTLE	METABOLIC COMPONENTS OF CATTLE UNDER LIGHT AND HEAVY RATES OF STOCKING IN 1970. (HYDER, ET. AL. 1971)	TR128
CELLULOSE	PROPOSAL FOR A CELLULOSE DECOMPOSITION STUDY AT THE PAWNEE SITE. (CLARK 1969)	AR69-2572.3
CHARACTERISTICS	METEOROLOGICAL CHARACTERISTICS OF HEAVILY AND LIGHTLY GRAZED NATURAL GRASS RANGE LAND. (NUNN, ET. AL. 1971)	OL015

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CHARACTERISTICS	PRELIMINARY RESULTS OF GROWTH CHARACTERISTICS OF BUFFALOGRASS, BLUE GRAMA, AND WESTER N WHEATGRASS, AND METHODOLOGY FOR TRANSLOCATION STUDIES USING 14C AS A TRACER. (KNIEVEL AND SCHMER 1971)	TR086
CHEMICAL	PHYSICAL AND CHEMICAL LIMNOLOGY OF COTTONWOOD POND AND SPRING POND (SEPT. 1969--DEC. 1970). (HERRMANN 1971)	TR071
CHEMICAL	A COMPARISON OF THE ESOPHAGEAL FISTULA WITH RUMEN SAMPLES FOR THE DETERMINATION OF TH E BOTANICAL AND CHEMICAL COMPOSITION OF THE DIET OF HERBIVORES. (RICE, ET. AL. 1969)	TR011
CHEMICAL	A COMPARISON OF THE ESOPHAGEAL OR RUMEN GRAB SAMPLING FOR THE BOTANICAL AND CHEMICAL DETERMINATION OF GRAZING SHEEP. (RICE AND CUNDY 1969)	AR69-2561.2
CHEMISTRY	SOIL CHEMISTRY AS A FACTOR IN THE FUNCTION OF GRASSLAND ECOSYSTEMS. (KLINE 1969)	SS02,71-88
CHEWING	CONSUMPTION AND METABOLIC RATES OF SOME LEAF-EATING, CHEWING ARTHROPODS: A SUMMARIZE D LITERATURE REVIEW. (MITCHELL 1971)	TR118
CLIMATE-PLANT	CLIMATE-PLANT RELATIONS AFFECTING SEMI-DESERT GRASSLAND HYDROLOGY. (COLLINS 1970)	SS06I,100-118
CLIMATOLOGY	SOME ASPECTS OF THE ECOLOGICAL CLIMATOLOGY OF THE JORNADA EXPERIMENTAL RANGE NEW-MEXI CO. (BRYSON, ET. AL. 1970)	SS06I,2-74
CLIMATOLOGY	PRELIMINARY REPORT ON THE STUDY OF THE CLIMATOLOGY OF THE PAWNEENATIONAL GRASSLAND. (BERTOLIN AND RASMUSSEN 1969)	AR69-2532.1
CLIMATOLOGY	GRASSLAND CLIMATOLOGY OF THE PAWNEE GRASSLAND. (RASMUSSEN, ET. AL. 1971)	TR127
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CLUMP	OPUNTIA CLUMP SIZE VARIATION ON THE SHORTGRASS PLAINS, PAWNEE SITE, NUNN, COLORADO. (LESTER AND FISSER 1970)	OL014
COLORADO	OPUNTIA CLUMP SIZE VARIATION ON THE SHORTGRASS PLAINS, PAWNEE SITE, NUNN, COLORADO. (LESTER AND FISSER 1970)	OL014
COLORADO	A STUDY OF RODENTS IN NORTH-EASTERN COLORADO. (FLAKE 1969)	AR69-2562.3
COLORADO	SUMMER ECOLOGY OF THE LARK-BUNTING IN NORTH-CENTRAL COLORADO. (CREIGHTON 1969)	AR69-2563.1
COLORADO	SOME COMPARISONS OF THE FEEDING ECOLOGY OF FOUR OWLS IN NORTH CENTRAL COLORADO. (MARTI 1969)	OL029
COLORADO	THE FEEDING REGIME OF GRANIVOROUS BIRDS IN SHORTGRASS PRAIRIE OF COLORADO. (BALDWIN 1970)	OL021
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COLORADO	AVIAN PRODUCTIVITY ON THE PAWNEE SITE IN NORTH-CENTRAL COLORADO. (STRONG AND RYDER 1971)	TR082
COLORADO	NESTING OF THE LARK-BUNTING IN NORTH-CENTRAL COLORADO. (CREIGHTON 1971)	TR068
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COMMUNITIES	A PRELIMINARY STUDY OF LENTIC COMMUNITIES ON THE PAWNEE NATIONAL GRASSLANDS. (LAVELLE, ET. AL. 1969)	AR69-2581-82
COMMUNITIES	REPLACEMENT OF NATIVE COMMUNITIES WITH INTRODUCED COMMUNITIES AND ITS IMPACT ON ECOSY STEM FUNCTION. (EVERSON 1969)	AR69-2552.2
COMMUNITIES	REPLACEMENT OF NATIVE COMMUNITIES WITH INTRODUCED COMMUNITIES AND ITS IMPACT ON ECOSY STEM FUNCTION. (EVERSON 1969)	AR69-2552.2
COMMUNITIES	PATTERN AND PROCESS IN GRASSLAND BIRD COMMUNITIES. (WIENS 1971)	SS10,147-212
COMMUNITY	PLANT COMMUNITY STRUCTURE. (RISSER 1971)	SS10,41-58
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COMPARISONS	COMPARISONS OF ABOVEGROUND PLANT BIOMASS ON UNGRAZED PASTURES VS. PASTURES GRAZED BY LARGE HERBIVORES. 1970 SEASON. (GRANT 1971)	TR131
COMPARISONS	SITE COMPARISONS OF ABOVEGROUND PLANT BIOMASS, 1970 SEASON. (GRANT 1971)	TR083
COMPARISONS	SOME COMPARISONS OF FEEDING ECOLOGY OF FOUR SPECIES OF OWLS IN NORTH-CENTRAL COLORADO . (MARTI 1969)	TR027
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COMPETITIVE	COMPETITIVE RELATIONSHIPS AMONG HERBACEOUS GRASSLAND PLANTS. (RISSER 1969)	OL031
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CONSUMED	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMED BY GRAZ ING CATTLE. (WALLACE AND VAN DYNE 1970)	OL006
CONSUMER	HABITAT HETEROGENEITY AND AVIAN CONSUMER POPULATIONS IN GRASSLANDS. (WIENS 1970)	SS07,83
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CO2	CO2 EXCHANGE OVER SHORTGRASS SODS. (DYE AND MOIR 1971)	TR081
CRICETIDAE	BIBLIOGRAPHY ON THE SPECIES AND GENUS SIGMODON (CRICETIDAE, RODENTIA). (SAVIC AND GOLLEY 1971)	TR129
CYCLE	THE GRASSLAND HYDROLOGIC CYCLE. (STRIFFLER 1969)	SS02,101-116
CYCLES	SEASONAL CARBOHYDRATE RESERVE CYCLES IN EIGHT DESERT RANGE SPECIES. (COYNE AND COOK 1970)	OL023
CYCLING	DECOMPOSER AND NITROGEN CYCLING INVESTIGATIONS IN THE GRASSLAND BIOME. (REUSS 1971)	SS10,133-146
DAKOTA	STUDIES OF POPULATIONS OF ADULTS AND IMMATURE INSECTS AND MITES FROM TWO TREATMENTS A T COTTONWOOD, SOUTH DAKOTA. (MCDANIEL 1971)	TR112
DEAD	DYNAMICS OF STANDING DEAD VEGETATION ON THE SHORTGRASS PLAINS. (BEMENT 1969)	SS02,221-224
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DECOMPOSERS	PRELIMINARY REPORT ON SAMPLING OF PRIMARY PRODUCERS, INVERTEBRATES, AND DECOMPOSERS ON THE JORNADA SITE, 1970. (PIEPER, ET. AL. 1971)	TR105
DECOMPOSERS	SOIL DECOMPOSERS. (ALEXANDER 1969)	SS02,403-409
DECOMPOSITION	DECOMPOSITION OF ORGANIC MATERIALS IN GRASSLAND SOIL. (CLARK 1970)	TR061
DECOMPOSITION	PROPOSAL FOR A CELLULOSE DECOMPOSITION STUDY AT THE PAWNEE SITE. (CLARK 1969)	AR69-2572.3
DEMOGRAPHIC	JACKRABBIT DEMOGRAPHIC AND LIFE HISTORY STUDIES, PAWNEE SITE. (GROSS 1969)	TR016
DENSITY	IDENTIFICATION OF INSECTS AND DENSITY DETERMINATIONS OF THE STOMACH CONTENTS OF SMALL MAMMALS. (CWIK 1970)	TR053
DENSITY	ORTHOPTERAN DENSITY AND BIOMASS STUDIES ON THE PAWNEE SITE, 1970 (WITH AN APPENDAGE ON ORTHOPTERAN STOMACH ANALYSIS). (BLOCKER, ET. AL. 1971)	TR124
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DETERMINATION	ESOPHAGEAL VS. FECAL SAMPLING FOR THE BOTANICAL DETERMINATION OF STEER DIETS. (VAVRA, ET. AL. 1970)	OL037
DETERMINATION	A COMPARISON OF THE ESOPHAGEAL OR RUMEN GRAB SAMPLING FOR THE BOTANICAL AND CHEMICAL DETERMINATION OF GRAZING SHEEP. (RICE AND CUNDY 1969)	AR69-2561.2
DETERMINATION	A COMPARISON OF THE ESOPHAGEAL FISTULA WITH RUMEN SAMPLES FOR THE DETERMINATION OF THE BOTANICAL AND CHEMICAL COMPOSITION OF THE DIET OF HERBIVORES. (RICE, ET. AL. 1969)	TR011
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DETERMINATIONS	BIOMASS DETERMINATIONS OF SOIL MICROORGANISMS. (DOXTADER 1970)	SS07,107-108
DETERMINING	WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTIONING BY CATTLE. (HYDER 1969)	AR69-2561.1
DETERMINING	METABOLIC COMPONENTS OF CATTLE: WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTITIONING BY CATTLE. (HYDER, ET. AL. 1969)	TR010
DEVELOPMENT	LAND MANAGEMENT POLICY AND DEVELOPMENT OF ECOLOGICAL CONCEPTS. (JAMESON 1970)	OL027
DICKINSON	COMPREHENSIVE NETWORK SITE DESCRIPTION, DICKINSON. (WHITMAN 1970)	TR040
DICKINSON	PRIMARY PRODUCTIVITY AND ABIOTIC STUDIES AT THE DICKINSON SITE, 1970 SEASON. (WHITMAN 1971)	TR116
DICKINSON	SMALL MAMMAL SURVEY ON THE BISON, BRIDGER, COTTONWOOD, DICKINSON, AND OSAGE SITES. (HOFFMANN, ET. AL. 1971)	TR109
DIET	DIET OF THE MOURNING-DOVE AT THE PAWNEE NATIONAL GRASSLAND, 1970-1971. (BALDWIN, ET. AL. 1971)	TR136
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DIET	THE MICROSCOPE METHOD USED FOR HERBIVORE DIET ESTIMATES AND BOTANICAL ANALYSIS OF LITTER AND MULCH AT THE PAWNEE SITE. (CAVENDER AND HANSEN 1970)	TR018
DIET	MEASURING QUANTITY AND QUALITY OF THE DIET OF LARGE HERBIVORES. (VAN DYNE 1969)	OL032
DIETARY	DIETARY SIMILARITY OF SOME PRIMARY CONSUMERS. (HANSEN AND UECKERT 1970)	OL025
DIETARY	DIETARY AND ENERGY RELATIONSHIPS OF JACKRABBITS AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	TR014
DIETS	DRAWINGS OF TISSUES OF PLANTS FOUND IN HERBIVORE DIETS AND IN THE LITTER OF GRASSLANDS. (HANSEN, ET. AL. 1971)	TR070
DIETS	DIETS AND HABITATS OF JACKRABBITS WITHIN A SHORTGRASS ECOSYSTEM. (FLINDERS AND HANSEN 1971)	TR098
DIETS	ESOPHAGEAL VS. FECAL SAMPLING FOR THE BOTANICAL DETERMINATION OF STEER DIETS. (VAVRA, ET. AL. 1970)	OL037
DIETS	METHODS OF ESTIMATING DRY WEIGHT COMPOSITION IN DIETS OF STEERS. (FREE, ET. AL. 1971)	OL011
DIETS	RELATIVE DRY WEIGHT ESTIMATES IN DIETS OF HERBIVORES BY THE MICROSCOPIC METHOD, AND SMALL MAMMAL BIOMASS ESTIMATION AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	AR69-2562.1
DIETS	DIETS AND ENERGY RELATIONS OF JACKRABBITS AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	AR69-2562

SIGNIFICANT-WORD	ARTICLE	REFERENCE
DIGESTIBILITY	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMED BY GRAZING CATTLE. (WALLACE AND VAN DYNE 1970)	OL006
DIGESTIBILITY	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMED BY GRAZING CATTLE. (WALLACE AND VAN DYNE 1970)	OL038
DIGITAL	EVALUATION OF A DIGITAL COMPUTER METHOD FOR ANALYSIS OF COMPARTMENTAL MODELS OF ECOLOGICAL SYSTEMS. (BLEDSOE AND VAN DYNE 1969)	OL022
DISEASES	THE ROLE OF DISEASES AND PARASITES IN A GRASSLAND ECOSYSTEM. (POST 1969)	SS02,300-306
DISPERSAL	DISPERSION AND DISPERSAL OF WHITE-TAILED AND BLACK-TAILED JACKRABBITS, PAWNEE NATIONAL GRASSLANDS. (DONOHO 1971)	TR096
DISPERSION	DISPERSION AND DISPERSAL OF WHITE-TAILED AND BLACK-TAILED JACKRABBITS, PAWNEE NATIONAL GRASSLANDS. (DONOHO 1971)	TR096
DISTRIBUTION	SPATIAL DISTRIBUTION AND SUCCESSIONAL STATE OF GRASSLAND VEGETATION RELATED TO GRAZING INTENSITY TREATMENTS. (MITCHELL 1971)	TR101
DISTRIBUTION	PLANT PATTERN AND DISTRIBUTION IN ECOSYSTEMS AND RELATIONSHIPS TO FUNCTION. (FISSER 1969)	SS02,183-196
DISTRIBUTION	AVIAN DISTRIBUTION AND POPULATION FLUCTUATIONS ON THE SHORTGRASS PRAIRIE OF NORTH CENTRAL COLORADO. (GIEZENTANNER 1970)	TR062
DISTRIBUTION	AVIAN ECOLOGY AND DISTRIBUTION IN THE COMPREHENSIVE NETWORK, 1970. (WIENS 1971)	TR077
DISTRIBUTION	AVIAN DISTRIBUTION AND POPULATION FLUCTUATIONS, PAWNEE SITE. (GIEZENTANNER AND RYDER 1969)	TR028
DISTRIBUTION	SOIL MACRO-ARTHROPOD SPECIES AND THEIR DISTRIBUTION AND ABUNDANCE IN THE GRASSLAND BIOME. (LLOYD 1969)	AR69-2571.1
DISTRIBUTION	ANALYSIS OF PLANT PATTERN, DISTRIBUTION AND RELATIONSHIP TO ENVIRONMENTAL PROCESSES. (FISSER AND LESHER 1969)	AR69-2553.1
DISTRIBUTION	DISTRIBUTION OF MICROORGANISMS IN PAWNEE SITE SOIL PROFILES. (MAYEUX AND JONES 1970)	SS07,112-120
DIURNAL	DIURNAL RAPTORS ON THE PAWNEE SITE. (RYDER 1969)	TR026
DOMESTIC	THE IMPACT OF DOMESTIC ANIMALS ON THE FUNCTION AND STRUCTURE OF GRASSLAND ECOSYSTEMS. (HYDER 1969)	SS02,243-260
DOMESTIC	RECIPROCAL INFLUENCES BETWEEN DOMESTIC ANIMALS AND OTHER COMPONENTS OF SEMI-DESERT ECOSYSTEMS. (HOUSTON 1970)	SS06I,178-190
DRAWINGS	DRAWINGS OF TISSUES OF PLANTS FOUND IN HERBIVORE DIETS AND IN THE LITTER OF GRASSLANDS. (HANSEN, ET. AL. 1971)	TR070
DYNAMICMODELS	SOME ANALYTICAL AND OPERATIONAL APPROACHES TO DEVELOPING DYNAMICMODELS OF ECOLOGICAL SYSTEMS. (VAN DYNE, ET. AL. 1971)	OL019
DYNAMICS	LIFE HISTORY, FOOD HABITS, HABITAT REQUIREMENTS, AND POPULATION DYNAMICS OF SMALL HERBIVORES ON SEMI-DESERT GRASSLANDS. (LAYCOCK 1970)	SS06I,198-212
DYNAMICS	LIFE HISTORY AND POPULATION DYNAMICS OF THE BLACK-TAILED JACKRABBIT (LEPUS CALIFORNICUS) IN NEW-MEXICO. (STODDART 1970)	SS06I,213-217
DYNAMICS	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
DYNAMICS	HERBAGE DYNAMICS STUDIES AT THE PANTEX SITE. (FAGAN AND PETTIT 1971)	TR078
DYNAMICS	A PRELIMINARY BIRD POPULATION DYNAMICS AND BIOMASS MODEL. (SWARTZMAN 1969)	TR003
DYNAMICS	DYNAMICS OF MULCH LAYER IN GRASSLAND ECOSYSTEMS. (TOMANEK 1969)	SS02,225-240
DYNAMICS	DYNAMICS OF STANDING DEAD VEGETATION ON THE SHORTGRASS PLAINS. (BEMENT 1969)	SS02,221-224
DYNAMICS	DYNAMICS OF THE ATMOSPHERE IN THE GRASSLAND ECOSYSTEM. (POCHOP 1969)	SS02,89-100
DYNAMICS	HERBAGE DYNAMICS ON A MIXED PRAIRIE GRASSLAND NEAR HAYS, KANSAS. (HULETT AND TOMANEK 1971)	TR108
DYNAMICS	ABIOTIC AND HERBAGE DYNAMICS STUDIES ON THE COTTONWOOD SITE, 1970. (LEWIS, ET. AL. 1971)	TR111
DYNAMICS	HERBAGE DYNAMICS ON THE PAWNEE SITE: ABOVEGROUND AND BELOWGROUND HERBAGE DYNAMICS ON THE FOUR GRAZING INTENSITY TREATMENTS; AND PRELIMINARY SAMPLING ON THE ECOSYSTEM STRESS SITE. (SIMS, ET. AL. 1971)	TR099
DYNAMICS	HERBAGE DYNAMICS ON THE PAWNEE SITE: ABOVEGROUND AND BELOWGROUND HERBAGE DYNAMICS ON THE FOUR GRAZING INTENSITY TREATMENTS; AND PRELIMINARY SAMPLING ON THE ECOSYSTEM STRESS SITE. (SIMS, ET. AL. 1971)	TR099
EASTERN	MODELS OF SEASONAL PRIMARY PRODUCTIVITY IN EASTERN TENNESSEE FESTUCA AND ANDROPOGON ECOSYSTEMS. (KELLY, ET. AL. 1969)	OL028

SIGNIFICANT-WORD	ARTICLE	REFERENCE
ECO-GENETIC	THE NATURE AND SIGNIFICANCE OF ECO-GENETIC VARIATION IN ECOSYSTEMS. (WARD 1969)	SS02,148-152
ECOSYSTEM	COMPETITIVE RELATIONSHIPS AMONG HERBACEOUS PLANTS AND THEIR INFLUENCES ON THE ECOSYSTEM FUNCTION IN GRASSLANDS. (RISSER 1969)	SS02,153-171
ECOSYSTEM	THE ROLE OF DISEASES AND PARASITES IN A GRASSLAND ECOSYSTEM. (POST 1969)	SS02,300-306
ECOSYSTEM	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTIONS. (CLARK 1969)	SS02,361-376
ECOSYSTEM	THE NATURE AND IMPORTANCE OF COMPETITION BETWEEN WOODY AND HERBACEOUS PLANTS IN A GRASSLAND ECOSYSTEM. (SHUBERT 1969)	SS02,172-182
ECOSYSTEM	THE ROLE OF HERBIVOROUS MAMMALS IN THE FUNCTIONING OF THE GRASSLAND ECOSYSTEM. (GROSS 1969)	SS02,268-278
ECOSYSTEM	MACROCLIMATE AND THE GRASSLAND ECOSYSTEM. (COLLINS 1969)	SS02,29-39
ECOSYSTEM	REPLACEMENT OF NATIVE PLANT COMMUNITIES WITH INTRODUCED COMMUNITIES AND ITS IMPACT ON ECOSYSTEM FUNCTION. (EVERSON 1969)	SS02,261-267
ECOSYSTEM	DYNAMICS OF THE ATMOSPHERE IN THE GRASSLAND ECOSYSTEM. (POCHOP 1969)	SS02,89-100
ECOSYSTEM	THE ROLE OF ABIOTIC FACTORS IN THE STRUCTURE AND FUNCTION OF THE GRASSLAND ECOSYSTEM. (BURZLAFF 1969)	SS02,117-123
ECOSYSTEM	THE ROLE OF CONSUMERS IN A GRASSLAND ECOSYSTEM. (PIEPER 1969)	SS02,316-329
ECOSYSTEM	MODEL STRUCTURE FOR A GRASSLAND ECOSYSTEM. (BLEDSOE AND JAMESON 1969)	SS02,410-437
ECOSYSTEM	HERBAGE DYNAMICS ON THE PAWNEE SITE: ABOVEGROUND AND BELOWGROUND HERBAGE DYNAMICS ON THE FOUR GRAZING INTENSITY TREATMENTS: AND PRELIMINARY SAMPLING ON THE ECOSYSTEM STRESS SITE. (SIMS, ET. AL. 1971)	TR099
ECOSYSTEM	DIETS AND HABITATS OF JACKRABBITS WITHIN A SHORTGRASS ECOSYSTEM. (FLINDERS AND HANSEN 1971)	TR098
ECOSYSTEM	SOIL WATER STUDY OF A SHORTGRASS PRAIRIE ECOSYSTEM, PAWNEE SITE. (GALBRAITH 1969)	TR006
ECOSYSTEM	MEASUREMENT OF THE ENERGY STATUS OF WATER IN A GRASSLAND ECOSYSTEM. (VAN HAVEREN 1971)	TR076
ECOSYSTEM	THE MICROBIAL COMPONENT OF THE ECOSYSTEM. (CLARK 1970)	TR052
ECOSYSTEM	PWNEE: A GRASSLAND ECOSYSTEM MODEL. (BLEDSOE, ET. AL. 1971)	TR064
ECOSYSTEM	SOIL MOVEMENT IN A GRASSLAND ECOSYSTEM AS MEASURED BY BETA PARTICLE ATTENUATION. (ALLDREDGE AND WHICKER 1971)	TR065
ECOSYSTEM	IMPLEMENTING THE ECOSYSTEM CONCEPT IN TRAINING IN NATURAL RESOURCE SCIENCES. (VAN DYNE 1969)	OL033
ECOSYSTEM	DATA AEQUISITION, STORAGE, AND RETRIEVAL FOR SOME RANGE ECOSYSTEM PLANNING. (SHIFLET 1970)	SS05,101-110
ECOSYSTEM	ABIOTIC FACTORS IN GRASSLAND ECOSYSTEM ANALYSIS AND FUNCTION. (RASMUSSEN 1971)	SS10,11-34
ECOSYSTEM	STRUCTURE OF ECOSYSTEM STUDIES ON AN INTERNATIONAL BASIS. (VAN DYNE 1970)	SS07,45-46
ECOSYSTEM	EXAMPLES OF TROPHIC LEVEL AND TOTAL ECOSYSTEM MODELS. (VAN DYNE 1970)	SS07,191-198
ECOSYSTEM	A GUIDE TO MATHEMATICAL MODELLING OF AN ECOSYSTEM. (CLYMER AND BLEDSOE 1970)	SS06I,75-99
ECOSYSTEM	AN ANALYSIS OF VEGETATION STRUCTURE ON THE PAWNEE GRASSLAND, WITH SUBSEQUENT EVALUATIONS OF THE INFLUENCE OF STRUCTURE ON ECOSYSTEM FUNCTION. (KNIGHT 1969)	AR69-2553.2
ECOSYSTEM	REPLACEMENT OF NATIVE COMMUNITIES WITH INTRODUCED COMMUNITIES AND ITS IMPACT ON ECOSYSTEM FUNCTION. (EVERSON 1969)	AR69-2552.2
ECOSYSTEM	OPTIMIZATION APPROACHES TO OPERATIONAL GRASSLAND ECOSYSTEM MANAGEMENT. (SWARTZMAN 1971)	OL017
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.5. (VAN DYNE 1970)	PR70-2.5
ECOSYSTEMS	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
ECOSYSTEMS	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.4. (VAN DYNE 1971)	PR71-2.4
ECOSYSTEMS	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1971-2.7. (VAN DYNE 1971)	PR71-2.7
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.52. (VAN DYNE 1969)	PR69-8.52
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.51. (VAN DYNE 1969)	PR69-8.51
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-5. (VAN DYNE 1969)	PR69-5.

SIGNIFICANT-WORD	ARTICLE	REFERENCE
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-4.1. (VAN DYNE 1970)	PR70-4.1
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.53 . (VAN DYNE 1969)	PR69-8.53
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-8. (VAN DYNE 1970)	PR70-8
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-0. (VAN DYNE 1969)	PR69-0
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.4. (VAN DYNE 1969)	PR69-8.4
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.4. (VAN DYNE 1970)	PR70-2.4
ECOSYSTEMS	ANALYSIS OF STRUCTURE, FUNCTION, AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS RE PORT 1971-6. (VAN DYNE 1971)	PR71-6
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-4. (VAN DYNE 1969)	PR69-4.
ECOSYSTEMS	RECIPROCAL INFLUENCES BETWEEN DOMESTIC ANIMALS AND OTHER COMPONENTS OF SEMI-DESERT EC OSYSTEMS. (HOUSTON 1970)	SS06I,178-190
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-6. (VAN DYNE 1969)	PR69-6.
ECOSYSTEMS	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-4.4. (VAN DYNE 1971)	PR71-4.4
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-9. (VAN DYNE 1969)	PR69-9
ECOSYSTEMS	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.6. (VAN DYNE 1971)	PR71-2.6
ECOSYSTEMS	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.6. (VAN DYNE 1970)	PR70-2.6
ECOSYSTEMS	MODELS OF SEASONAL PRIMARY PRODUCTIVITY IN EASTERN TENNESSEE FESTUCA AND ANDROPOGON E COSYSTEMS. (KELLY, ET. AL. 1969)	OL028
ECOSYSTEMS	SOME MATHEMATICAL MODELS OF GRASSLAND ECOSYSTEMS. (VAN DYNE 1969)	SS02,3-26
ECOSYSTEMS	ENERGRY FIXATION AND THE ROLE OF PRIMARY PRODUCERS IN ENERGY FLUX OF GRASSLAND ECOSYS TEMS. (MOIR 1969)	SS02,125-147
ECOSYSTEMS	DYNAMICS OF MULCH LAYER IN GRASSLAND ECOSYSTEMS. (TOMANEK 1969)	SS02,225-240
ECOSYSTEMS	MICROCLIMATE AND ITS IMPORTANCE IN GRASSLAND ECOSYSTEMS. (WHITMAN 1969)	SS02,40-64
ECOSYSTEMS	SOME INFLUENCES OF VEGETATION STRUCTURE ON ENERGY-FLUX, WATER-FLUX, AND NUTRIENT-FLUX IN GRASSLAND ECOSYSTEMS. (KNIGHT 1969)	SS02,197-220
ECOSYSTEMS	PLANT PATTERN AND DISTRIBUTION IN ECOSYSTEMS AND RELATIONSHIPS TO FUNCTION. (FISSER 1969)	SS02,183-196
ECOSYSTEMS	BIRDS IN GRASSLAND ECOSYSTEMS. (GLOVER 1969)	SS02,279-289
ECOSYSTEMS	THE IMPACT OF INSECTS AS HERBIVORES IN GRASSLAND ECOSYSTEMS. (BLOCKER 1969)	SS02,290-299
ECOSYSTEMS	BASIC CONCEPTS IN MATHEMATICAL MODELLING OF GRASSLAND ECOSYSTEMS. (JAMESON 1970)	SS05,1-15
ECOSYSTEMS	THE IMPACT OF DOMESTIC ANIMALS ON THE FUNCTION AND STRUCTURE OF GRASSLAND ECOSYSTEMS. (HYDER 1969)	SS02,243-260
ECOSYSTEMS	SOIL CHEMISTRY AS A FACTOR IN THE FUNCTION OF GRASSLAND ECOSYSTEMS. (KLINF 1969)	SS02,71-88
ECOSYSTEMS	NITROGEN IN GRASSLAND ECOSYSTEMS. (PORTER 1969)	SS02,377-402
ECOSYSTEMS	THE IMPORTANCF AND ROLE OF AMPHIBIANS AND REPTILES IN GRASSLAND ECOSYSTEMS. (THOMAS 1970)	SS02S307,1-23
ECOSYSTEMS	PRIMARY PRODUCERS IN GRASSLAND ECOSYSTEMS. (LEWIS 1970)	SS02S241,1-87
ECOSYSTEMS	THE NATURE AND SIGNIFICANCE OF ECO-GENETIC VARIATION IN ECOSYSTEMS. (WARD 1969)	SS02,148-152
ECOSYSTEMS	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
ELDORADO	AN EXAMPLE OF OPTIMIZATION TECHNIQUES IN LAND MANAGEMENT: THE ELDORADO MODEL. (BELL 1970)	SS05,75-87
ELECTRONIC	USE OF ELECTRONIC METER IN ESTIMATING BIOMASS. (JAMESON 1970)	SS07,65
ENERGRY	ENERGRY FIXATION AND THE ROLE OF PRIMARY PRODUCERS IN ENERGY FLUX OF GRASSLAND ECOSYS TEMS. (MOIR 1969)	SS02,125-147

SIGNIFICANT-WORD	ARTICLE	REFERENCE
ENERGY	ENERGRY FIXATION AND THE ROLE OF PRIMARY PRODUCERS IN ENERGY FLUX OF GRASSLAND ECOSYSTEMS. (MOIR 1969)	SS02,125-147
ENERGY	MEASUREMENT OF THE ENERGY STATUS OF WATER IN A GRASSLAND ECOSYSTEM. (VAN HAVEREN 1971)	TR076
ENERGY	DIETARY AND ENERGY RELATIONSHIPS OF JACKRABBITS AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	TR014
ENERGY	DIETS AND ENERGY RELATIONS OF JACKRABBITS AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	AR69-2562
ENERGY-FLUX	ENERGY-FLUX AND WATER KINETICS IN YOUNG PRONGHORN ANTELOPE. (WESLEY, ET. AL. 1970)	OL040
ENERGY-FLUX	SOME INFLUENCES OF VEGETATION STRUCTURE ON ENERGY-FLUX, WATER-FLUX, AND NUTRIENT-FLUX IN GRASSLAND ECOSYSTEMS. (KNIGHT 1969)	SS02,197-220
ENGINEERING	ENGINEERING IN ECOLOGY. (NUNN 1971)	OL008
ENTEROTOXEMIA	CLOSTRIDIUM PERFRINGENS ENTEROTOXEMIA IN HARD REARED ANTELOPE. (NAGY, ET. AL. 1969)	OL001
ENTOMOLOGICAL	ENTOMOLOGICAL PROJECT 7103, GRASSLAND BIOME. (THATCHER 1969)	AR69-2564.2
ENVIRONMENTAL	ANALYSIS OF PLANT PATTERN, DISTRIBUTION AND RELATIONSHIP TO ENVIRONMENTAL PROCESSES. (FISSER AND LESHER 1969)	AR69-2553.1
ENVIRONMENTAL	ENVIRONMENTAL POLLUTANTS IN TWO SPECIES OF SNAKES FROM THE PAWNEE SITE. (BAUERLE AND SPENCER 1971)	TR137
EQUATIONS	ODE: NUMERICAL ANALYSIS FOR ORDINARY DIFFERENTIAL EQUATIONS. (BLEDSOE 1970)	TR046
EQUATIONS	COMPARATIVE ANALYTICAL STUDIES OF SITE FACTOR EQUATIONS. (WRIGHT AND VAN DYNE 1971)	OL020
ESOPHAGEAL	A COMPARISON OF THE ESOPHAGEAL OR RUMEN GRAB SAMPLING FOR THE BOTANICAL AND CHEMICAL DETERMINATION OF GRAZING SHEEP. (RICE AND CUNDY 1969)	AR69-2561.2
ESOPHAGEAL	ESOPHAGEAL VS. FECAL SAMPLING FOR THE BOTANICAL DETERMINATION OF STEER DIETS. (VAVRA, ET. AL. 1970)	OL037
ESOPHAGEAL	A COMPARISON OF THE ESOPHAGEAL FISTULA WITH RUMEN SAMPLES FOR THE DETERMINATION OF THE BOTANICAL AND CHEMICAL COMPOSITION OF THE DIET OF HERBIVORES. (RICE, ET. AL. 1969)	TR011
EVALUATION	EVALUATION OF A DIGITAL COMPUTER METHOD FOR ANALYSIS OF COMPARTMENTAL MODELS OF ECOLOGICAL SYSTEMS. (BLEDSOE AND VAN DYNE 1969)	OL022
EVALUATIONS	AN ANALYSIS OF VEGETATION STRUCTURE ON THE PAWNEE GRASSLAND, WITH SUBSEQUENT EVALUATIONS OF THE INFLUENCE OF STRUCTURE ON ECOSYSTEM FUNCTION. (KNIGHT 1969)	AR69-2553.2
EVAPORATION	MODELS FOR INFERRING EVAPORATION FROM METEOROLOGICAL MEASUREMENTS. (NUNN, ET. AL. 1970)	TR047
FACTOR	SOIL CHEMISTRY AS A FACTOR IN THE FUNCTION OF GRASSLAND ECOSYSTEMS. (KLINE 1969)	SS02,71-88
FACTOR	COMPARATIVE ANALYTICAL STUDIES OF SITE FACTOR EQUATIONS. (WRIGHT AND VAN DYNE 1971)	OL020
FACTORS	ABIOTIC FACTORS IN GRASSLAND ECOSYSTEM ANALYSIS AND FUNCTION. (RASMUSSEN 1971)	SS10,11-34
FACTORS	THE ROLE OF ABIOTIC FACTORS IN THE STRUCTURE AND FUNCTION OF THE GRASSLAND ECOSYSTEM. (BURZLAFF 1969)	SS02,117-123
FAUNA	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
FAUNAL	A NUMERICAL ANALYSIS OF GRASSLAND FAUNAL RESEMBLANCES. (WELCH 1970)	TR060
FECAL	ESOPHAGEAL VS. FECAL SAMPLING FOR THE BOTANICAL DETERMINATION OF STEER DIETS. (VAVRA, ET. AL. 1970)	OL037
FECES	ESTIMATING DRY WEIGHTS OF FOOD PLANTS IN FECES OF HERBIVORES. (FREE, ET. AL. 1970)	OL003
FEEDING	THE FEEDING REGIME OF GRANIVOROUS BIRDS IN SHORTGRASS PRAIRIE OF COLORADO. (BALDWIN 1970)	OL021
FEEDING	THE EFFECT OF INSECT PREDATORS AND PARASITES ON GRASS FEEDING INSECTS. (LAVIGNE 1969)	AR69-2564.3
FEEDING	SOME COMPARISONS OF THE FEEDING ECOLOGY OF FOUR OWLS IN NORTH CENTRAL COLORADO. (MARTI 1969)	OL029
FEEDING	PROGRESS REPORT, WORK ON BIRD FEEDING AND NESTING BEHAVIOR AT THE PAWNEE SITE. (CREIGHTON 1971)	TR067
FEEDING	SOME COMPARISONS OF FEEDING ECOLOGY OF FOUR SPECIES OF OWLS IN NORTH-CENTRAL COLORADO . (MARTI 1969)	TR027
FEEDING	EFFECT OF INSECT PREDATORS AND PARASITES ON GRASS FEEDING INSECTS, PAWNEE SITE. (LAVIGNE AND ROGERS 1970)	TR020

SIGNIFICANT-WORD	ARTICLE	REFERENCE
FESCUE	PRIMARY PRODUCTIVITY OF THE FESCUE GRASSLAND IN WESTERN MONTANA. (MORRIS AND BRUNNER 1971)	TR113
FESTUCA	MODELS OF SEASONAL PRIMARY PRODUCTIVITY IN EASTERN TENNESSEE FESTUCA AND ANDROPOGON ECOSYSTFMS. (KFLLY, ET. AL. 1969)	OL028
FISTULA	A COMPARISON OF THE ESOPHAGEAL FISTULA WITH RUMEN SAMPLES FOR THE DETFRMINATION OF THE BOTANICAL AND CHEMICAL COMPOSITION OF THE DIET OF HERBIVORES. (RICE, ET. AL. 1969)	TR011
FIXATION	ENERGRY FIXATION AND THE ROLE OF PRIMARY PRODUCERS IN ENERGY FLUX OF GRASSLAND ECOSYSTEMS. (MOIR 1969)	SS02,125-147
FLUCTUATIONS	AVIAN DISTRIBUTION AND POPULATION FLUCTUATIONS, PAWNEE SITE. (GIEZENTANNER AND RYDER 1969)	TR028
FLUCTUATIONS	AVIAN DISTRIBUTION AND POPULATION FLUCTUATIONS ON THE SHORTGRASS PRAIRIE OF NORTH CENTRAL COLORADO. (GIEZENTANNFR 1970)	TR062
FLUX	ENERGY FIXATION AND THE ROLE OF PRIMARY PRODUCERS IN ENERGY FLUX OF GRASSLAND ECOSYSTEMS. (MOIR 1969)	SS02,125-147
FOOD	PRONGHORN ANTELOPE FIELD FOOD CONSUMPTION STUDIES. (NAGY AND HOOVER 1971)	TR087
FOOD	ESTIMATING DRY WEIGHTS OF FOOD PLANTS IN FECES OF HERBIVORES. (FREE, ET. AL. 1970)	OL003
FOOD	LIFE HISTORY, FOOD HABITS, HABITAT REQUIREMENTS, AND POPULATION DYNAMICS OF SMALL HERBIVORES ON SEMI-DESERT GRASSLANDS. (LAYCOCK 1970)	SS06I,198-212
FOOD	AVIAN FOOD STUDIES AT THE PAWNEE SITE. (BALDWIN 1970)	SS07,84-85
FORAGE	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMED BY GRAZING CATTLE. (WALLACE AND VAN DYNE 1970)	OL006
FORAGE	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMED BY GRAZING CATTLE. (WALLACE AND VAN DYNE 1970)	OL038
FORAGE	HERBAGE GROWTH RATE, FORAGE INTAKE, AND FORAGE QUALITY IN 1970 ON HEAVILY AND LIGHTLY GRAZED BLUE GRAMA PASTURES. (DYCK AND BEMENT 1971)	TR094
FORAGE	HERBAGE GROWTH RATE, FORAGE INTAKE, AND FORAGE QUALITY IN 1970 ON HEAVILY AND LIGHTLY GRAZED BLUE GRAMA PASTURES. (DYCK AND BEMENT 1971)	TR094
FOREIGN	SOME OBSERVATIONS ON FOREIGN GRASSLAND AND RELATED RESEARCH: APRIL-JULY, 1970 VAN DYNE TRIP REPORT. (VAN DYNE 1970)	TR057
FOREST-RANGE	SIMULATION TECHNIQUES IN FOREST-RANGE MANAGEMENT. (CLIFFORD AND CURRIE 1970)	SS05,17-22
FORMAT	STYLE AND FORMAT OF TECHNICAL REPORTS. (HENDRICKS 1970)	TR056
FUNCTIONAL	FUNCTIONAL INTERACTION OF LARGE HERBIVORES ON GRASSLANDS. (RICE, ET. AL. 1971)	SS10,241-266
FUNCTIONING	THE MEASUREMENT OF PERCENT OF FUNCTIONING VEGETATION IN GRASSLAND AREAS. (MILLER 1969)	AR69-2520
FUNCTIONING	A FIELD LIGHT QUALITY LABORATORY--INITIAL EXPERIMENT: THE MEASUREMENT OF PERCENT OF FUNCTIONING VEGETATION IN GRASSLAND AREAS BY REMOTE SENSING METHODOLOGY. (PEARSON, ET. AL. 1971)	TR090
FUNCTIONING	THE ROLE OF HERBIVOROUS MAMMALS IN THE FUNCTIONING OF THE GRASSLAND ECOSYSTFM. (GROSS 1969)	SS02,268-278
FUNCTIONS	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTIONS. (CLARK 1969)	SS02,361-376
GENERALIZED	CURRENT GENERALIZED COMPUTER PROGRAMS USED IN GRASSLAND BIOME ANALYSES. (SWIFT, ET. AL. 1970)	TR034
GENERATOR	MULTIVARIATE NORMAL DATA GENERATOR. (BLEDSOE AND GUSTAFSON 1971)	TR092
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MODELLING	BASIC CONCEPTS IN MATHEMATICAL MODELLING OF GRASSLAND ECOSYSTEMS. (JAMESON 1970)	SS05,1-15
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NATURAL	SOME OPTIMIZATION TECHNIQUES AND PROBLEMS IN THE NATURAL RESOURCE SCIENCES. (VAN DYNE, ET. AL. 1970)	OL036
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OPTIMIZATION	OPTIMIZATION APPROACHES TO OPERATIONAL GRASSLAND ECOSYSTEM MANAGEMENT. (SWARTZMAN 1971)	OL017
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OPTIMIZATION	AN EXAMPLE OF OPTIMIZATION TECHNIQUES IN LAND MANAGEMENT: THE ELDORADO MODEL. (BELL 1970)	SS05,75-87
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OSAGE	1970 INSECT STUDIES AT OSAGE COMPREHENSIVE SITE. (BLOCKER AND REED 1971)	TR093
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PARASITES	THF EFFECT OF INSECT PREDATORS AND PARASITES ON GRASS FEEDING INSECTS. (LAVIGNE 1969)	AR69-2564.3
PARTIONING	WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTIONING BY CATTLE. (HYDER 1969)	AR69-2561.1
PASTURES	HERBAGE GROWTH RATE, FORAGE INTAKE, AND FORAGE QUALITY IN 1970 ON HEAVILY AND LIGHTLY GRAZED BLUE GRAMA PASTURES. (DYCK AND BEMENT 1971)	TR094
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PATTERN	ANALYSIS OF PLANT PATTERN, DISTRIBUTION AND RELATIONSHIP TO ENVIRONMENTAL PROCESSES. (FISSER AND LESHER 1969)	AR69-2553.1
PATTERNS	AVIAN POPULATIONS AND PATTERNS OF HABITAT OCCUPANCY AT THE PAWNEE SITF, 1968-1969. (WEINS 1970)	TR063
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PAWNEE	DATA COLLECTED ON THE PAWNEE SITE RELATING TO WESTERN HARVESTER ANT AND INSECT PREDATORS AND PARASITES, 1970. (LAVIGNE, ET. AL. 1971)	TR107
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PAWNEE	STUDIES OF PRODUCER BIOMASS AT THE PAWNEE SITE. (SIMS 1970)	SS07,60-61
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PAWNEE	PLANS FOR INSTRUMENTATION AT THE PAWNEE SITE. (BURMAN 1970)	SS07,150

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PAWNEE	DISTRIBUTION OF MICROORGANISMS IN PAWNEE SITE SOIL PROFILES. (MAYEUX AND JONES 1970)	SS07,112-120
PAWNEE	OBJECTIVES OF CONSUMER STUDIES AT THE PAWNEE SITE. (HANSEN 1970)	SS07,70
PAWNEE	ABOVEGROUND INSECTS ON THE PAWNEE SITE, 1970. (DICKINSON AND LEETHAM 1971)	TR123
PAWNEE	SOME HYDROLOGIC AND PHYSICAL PROPERTIES OF THE MAJOR SOIL TYPES ON THE PAWNEE INTENSIVE SITE. (VAN HAVEREN, GALBRAITH 1971)	TR115
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PAWNEE	DIET OF THE MOUNTAIN-PLOVER AT THE PAWNEE NATIONAL GRASSLAND, 1970-1971. (BALDWIN 1971)	TR134
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PAWNEE	DIET OF THE KILLDEER AT THE PAWNEE NATIONAL GRASSLAND AND A COMPARISON WITH THE MOUNTAIN-PLOVER, 1970-71. (BALDWIN 1971)	TR135
PAWNEE	ORTHOPTERAN DENSITY AND BIOMASS STUDIES ON THE PAWNEE SITE, 1970 (WITH AN APPENDAGE ON ORTHOPTERAN STOMACH ANALYSIS). (BLOCKER, ET. AL. 1971)	TR124
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PAWNEE	DIETS AND ENERGY RELATIONS OF JACKRABBITS AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	AR69-2562
PAWNEE	AN ANALYSIS OF VEGETATION STRUCTURE ON THE PAWNEE GRASSLAND, WITH SUBSEQUENT EVALUATIONS OF THE INFLUENCE OF STRUCTURE ON ECOSYSTEM FUNCTION. (KNIGHT 1969)	AR69-2553.2
PAWNEE	RELATIVE DRY WEIGHT ESTIMATES IN DIETS OF HERBIVORES BY THE MICROSCOPIC METHOD, AND SMALL MAMMAL BIOMASS ESTIMATION AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	AR69-2562.1
PAWNEE	PRELIMINARY METHODOLOGY AND RESULTS FOR ABOVEGROUND HERBAGE BIOMASS SAMPLING ON THE PAWNEE SITE. (SIMS 1969)	AR69-2552.1
PAWNEE	MICROBIAL BIOMASS MEASUREMENTS AT THE PAWNEE SITE, PRELIMINARY METHODOLOGY AND RESULTS. (DOXTADER 1969)	AR69-2572.1
PAWNEE	AVIAN POPULATIONS AT THE PAWNEE SITE. (RYDER 1969)	AR69-2563.2
PAWNEE	BACTERIAL ECOLOGY OF PAWNEE GRASSLAND SOILS. (MAYEUX AND JONES 1969)	AR69-2572.2
PAWNEE	OPUNTIA CLUMP SIZE VARIATION ON THE SHORTGRASS PLAINS, PAWNEE SITE, NUNN, COLORADO. (LESTER AND FISSER 1970)	OL014
PAWNEE	PROPOSAL FOR A CELLULOSE DECOMPOSITION STUDY AT THE PAWNEE SITE. (CLARK 1969)	AR69-2572.3
PAWNEE	A PRELIMINARY STUDY OF LENTIC COMMUNITIES ON THE PAWNEE NATIONAL GRASSLANDS. (LAVELLE, ET. AL. 1969)	AR69-2581-82
PAWNEE	REPORT ON ORTHOPTERA RESEARCH AT THE PAWNEE SITE DURING 1969. (HORN 1969)	AR69-2564.1
PAWNEENATIONAL	PRELIMINARY REPORT ON THE STUDY OF THE CLIMATOLOGY OF THE PAWNEENATIONAL GRASSLAND. (BERTOLIN AND RASMUSSEN 1969)	AR69-2532.1
PERSONNEL	SCIENTIFIC PERSONNEL PARTICIPATING IN THE GRASSLAND BIOME STUDY, JUNE 1968 THROUGH JANUARY 1970. (WRIGHT 1970)	TR024
PHOTOSYNTHESIS	PHOTOSYNTHESIS OF SHORTGRASSES UNDER FIELD CONDITIONS. (MOIR, ET. AL. 1969)	TR031
PHOTOSYNTHESIS	A PHOTOSYNTHESIS MEASUREMENT SYSTEM FOR THE PAWNEE SITE. (MOIR 1970)	SS07,151-154
PHOTOSYNTHESIS	PHOTOSYNTHESIS OF SHORTGRASSES UNDER FIELD CONDITIONS. (MOIR 1969)	AR69-2551.1
PHYSICAL	SOIL PHYSICAL CONDITIONS AFTER PLOWING AND PACKING OF RIDGES. (HYDER AND BEMENT 1970)	OL026
PHYSICAL	PHYSICAL PROPERTIES OF GRASSLAND SOILS AND THEIR INFLUENCE ON PRIMARY PRODUCTIVITY. (TERWILLIGER 1969)	SS02,65-70
PHYSICAL	SOME HYDROLOGIC AND PHYSICAL PROPERTIES OF THE MAJOR SOIL TYPES ON THE PAWNEE INTENSIVE SITE. (VAN HAVEREN, GALBRAITH 1971)	TR115
PHYSICAL	PHYSICAL AND CHEMICAL LIMNOLOGY OF COTTONWOOD POND AND SPRING POND (SEPT. 1969--DEC. 1970). (HERRMANN 1971)	TR071
PHYSICAL-CHEMICAL	AQUATIC PRIMARY PRODUCTIVITY AND PHYSICAL-CHEMICAL LIMNOLOGY ON THE PAWNEE SITE. (HERRMANN, ET. AL. 1970)	TR049

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PLANNING	DATA AEQUISITION, STORAGE, AND RETRIEVAL FOR SOME RANGE ECOSYSTEM PLANNING. (SHIFLET 1970)	SS05,101-110
PLANS	PLANS FOR INSTRUMENTATION AT THE PAWNEE SITE. (BURMAN 1970)	SS07,150
PLOWING	SOIL PHYSICAL CONDITIONS AFTER PLOWING AND PACKING OF RIDGES. (HYDER AND BEMENT 1970)	OL026
POLICY	LAND MANAGEMENT POLICY AND DEVELOPMENT OF ECOLOGICAL CONCEPTS. (JAMESON 1970)	OL027
POLLUTANTS	ENVIRONMENTAL POLLUTANTS IN TWO SPECIES OF SNAKES FROM THE PAWNEE SITE. (BAUERLE AND SPENCER 1971)	TR137
POND	PHYSICAL AND CHEMICAL LIMNOLOGY OF COTTONWOOD POND AND SPRING POND (SEPT. 1969--DEC. 1970). (HERRMANN 1971)	TR071
POND	PHYSICAL AND CHEMICAL LIMNOLOGY OF COTTONWOOD POND AND SPRING POND (SEPT. 1969--DEC. 1970). (HERRMANN 1971)	TR071
POPULATION	INSECT POPULATION STUDIES. (HUDDLESTON, ET. AL. 1971)	TR079
POPULATION	AVIAN DISTRIBUTION AND POPULATION FLUCTUATIONS, PAWNEE SITE. (GIEZENTANNER AND RYDER 1969)	TR028
POPULATION	AVIAN DISTRIBUTION AND POPULATION FLUCTUATIONS ON THE SHORTGRASS PRAIRIE OF NORTH CEN TRAL COLORADO. (GIEZENTANNER 1970)	TR062
POPULATION	A PRELIMINARY BIRD POPULATION DYNAMICS AND BIOMASS MODEL. (SWARTZMAN 1969)	TR003
POPULATION	COMPARISON OF SOME IBP POPULATION ESTIMATES METHODS FOR SMALL MAMMALS. (FRENCH, ET. AL. 1970)	OL012
POPULATION	LIFE HISTORY AND POPULATION DYNAMICS OF THE BLACK-TAILED JACKRABBIT (LEPUS CALIFORNI CUS) IN NEW-MEXICO. (STODDART 1970)	SS06I,213-217
POPULATION	LIFE HISTORY, FOOD HABITS, HABITAT REQUIREMENTS, AND POPULATION DYNAMICS OF SMALL HER BIVORES ON SEMI-DESERT GRASSLANDS. (LAYCOCK 1970)	SS06I,198-212
POPULATIONS	AVIAN POPULATIONS AT THE PAWNEE SITE. (RYDER 1969)	AR69-2563.2
POPULATIONS	SAMPLING INSECT POPULATIONS BY SWEEP NET ON THE PAWNEE SITE. (THATCHER, ET. AL. 1970)	TR050
POPULATIONS	SOME CONTRIBUTIONS TO THE STUDY OF GRASSLANDS INSECT POPULATIONS. (HUDDLESTON, ET. AL. 1969)	TR048
POPULATIONS	AVIAN POPULATIONS AND PATTERNS OF HABITAT OCCUPANCY AT THE PAWNEE SITF, 1968-1969. (WEINS 1970)	TR063
POPULATIONS	STUDIES OF POPULATIONS OF ADULTS AND IMMATURE INSECTS AND MITES FROM TWO TREATMENTS A T COTTONWOOD, SOUTH DAKOTA. (MCDANIEL 1971)	TR112
POPULATIONS	AVIAN POPULATIONS AT THE PAWNEE SITE. (RYDER 1970)	SS07,89-91
POPULATIONS	HABITAT HETEROGENEITY AND AVIAN CONSUMER POPULATIONS IN GRASSLANDS. (WIENS 1970)	SS07,83
PRECIPITATION	PRELIMINARY REPORT ON THE STUDY OF THE PRECIPITATION ON THE PAWNEE NATIONAL GRASSLAND . (BERTOLIN AND RASMUSSEN 1969)	TR017
PRECIPITATION	GROWING SEASON PRECIPITATION RECORDS, CENTRAL PLAINS EXPERIMENTAL RANGE A.R.S., NUNN, COLORADO. (SMITH 1971)	TR074
PRECIS	A PRECIS OF SMALL MAMMAL STUDIES AND RESULTS IN THE GRASSLAND BIOME. (HARRIS 1971)	SS10,213-240
PRECISION	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMED BY GRAZ ING CATTLE. (WALLACE AND VAN DYNE 1970)	OL006
PRECISION	PRECISION OF INDIRECT METHODS FOR ESTIMATING DIGESTIBILITY OF FORAGE CONSUMFD BY GRAZ ING CATTLE. (WALLACE AND VAN DYNE 1970)	OL038
PREDATION	A PRELIMINARY MODEL FOR CONSUMER PREDATION. (HARRIS AND SWARTZMAN 1971)	TR119
PREDATORS	DATA COLLECTED ON THE PAWNEE SITE RELATING TO WESTERN HARVESTER ANT AND INSFCT PREDAT ORS AND PARASITES, 1970. (LAVIGNE, ET. AL. 1971)	TR107
PREDATORS	EFFECT OF INSFCT PREDATORS AND PARASITES ON GRASS FEEDING INSECTS, PAWNEE SITE. (LAVIGNE AND ROGERS 1970)	TR020
PREDATORS	THE EFFECT OF INSECT PREDATORS AND PARASITES ON GRASS FEEDING INSECTS. (LAVIGNE 1969)	AR69-2564.3
PRIMARY	DIETARY SIMILARITY OF SOME PRIMARY CONSUMERS. (HANSEN AND UECKERT 1970)	OL025
PRIMARY	MODELS OF SEASONAL PRIMARY PRODUCTIVITY IN EASTERN TENNESSEE FESTUCA AND ANDROPOGON E COSYSTEMS. (KELLY, ET. AL. 1969)	OL028
PRIMARY	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
PRIMARY	AQUATIC PRIMARY PRODUCTIVITY AND PHYSICAL-CHEMICAL LIMNOLOGY ON THE PAWNEE SITE. (HERRMANN, ET. AL. 1970)	TR049

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PRIMARY	OSAGE SITE, 1970 REPORT, PRIMARY PRODUCTION. (RISSER 1971)	TR080
PRIMARY	PRELIMINARY REPORT ON SAMPLING OF PRIMARY PRODUCERS, INVERTEBRATES, AND DECOMPOSERS ON THE JORNADA SITE, 1970. (PIEPER, ET. AL. 1971)	TR105
PRIMARY	ENERGRY FIXATION AND THE ROLE OF PRIMARY PRODUCERS IN ENERGY FLUX OF GRASSLAND ECOSYSTEMS. (MOIR 1969)	SS02,125-147
PRIMARY	PRIMARY PRODUCTIVITY AND ABIOTIC STUDIES AT THE DICKINSON SITE, 1970 SEASON. (WHITMAN 1971)	TR116
PRIMARY	PHYSICAL PROPERTIES OF GRASSLAND SOILS AND THEIR INFLUENCE ON PRIMARY PRODUCTIVITY. (TERWILLIGER 1969)	SS02,65-70
PRIMARY	PRIMARY PRODUCTIVITY OF THE FESCUE GRASSLAND IN WESTERN MONTANA. (MORRIS AND BRUNNER 1971)	TR113
PRIMARY	PRIMARY PRODUCERS IN GRASSLAND ECOSYSTEMS. (LEWIS 1970)	SS02S241,1-87
PROBLEMS	PROBLEMS IN MEASURING GRASSLAND PRODUCTIVITY. (JAMESON 1970)	SS07,58
PROBLEMS	SOME OPTIMIZATION TECHNIQUES AND PROBLEMS IN THE NATURAL RESOURCE SCIFNCES. (VAN DYNE, ET. AL. 1970)	OL036
PROCEDURES	BASIC FIELD DATA COLLECTION PROCEDURES FOR THE GRASSLAND BIOME 1971 SFASON. (FRENCH, ET. AL. 1971)	TR085
PROCEDURES	FIELD DATA COLLECTION PROCEDURES FOR THE COMPREHENSIVE NETWORK 1970 SFASON. (FRENCH 1970)	TR035
PROCEDURES	MEMORANDA OF AGREEMENT AND PROCEDURES FOR WORKING ON FEDERAL LANDS OF THE USDA. (JAMESON AND NELL 1970)	TR008
PRODUCER	STUDIES OF PRODUCER BIOMASS AT THE PAWNEE SITE. (SIMS 1970)	SS07,60-61
PRODUCER	PRODUCER FUNCTION ON THE INTENSIVE AND COMPREHENSIVE SITES. (WILLIAMS 1971)	SS10,125-132
PRODUCERS	PRIMARY PRODUCERS IN GRASSLAND ECOSYSTEMS. (LEWIS 1970)	SS02S241,1-87
PRODUCERS	TECHNIQUES IN MEASURING BIOMASS OF PRODUCERS. (VAN DYNE, ET. AL. 1970)	SS07,62-64
PRODUCERS	ENERGY FIXATION AND THE ROLE OF PRIMARY PRODUCERS IN ENERGY FLUX OF GRASSLAND ECOSYSTEMS. (MOIR 1969)	SS02,125-147
PRODUCERS	PRELIMINARY REPORT ON SAMPLING OF PRIMARY PRODUCERS, INVERTEBRATES, AND DECOMPOSERS ON THE JORNADA SITE, 1970. (PIEPER, ET. AL. 1971)	TR105
PRODUCTION	OSAGE SITE, 1970 REPORT, PRIMARY PRODUCTION. (RISSER 1971)	TR080
PRODUCTION	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
PRODUCTIVITY	MODELS OF SEASONAL PRIMARY PRODUCTIVITY IN EASTERN TENNESSEE FESTUCA AND ANDROPOGON ECOSYSTEMS. (KELLY, ET. AL. 1969)	OL028
PRODUCTIVITY	AVIAN PRODUCTIVITY ON THE PAWNEE SITE IN NORTH-CENTRAL COLORADO. (STRONG AND RYDER 1971)	TR082
PRODUCTIVITY	AQUATIC PRIMARY PRODUCTIVITY AND PHYSICAL-CHEMICAL LIMNOLOGY ON THE PAWNEE SITE. (HERRMANN, ET. AL. 1970)	TR049
PRODUCTIVITY	PRIMARY PRODUCTIVITY AND ABIOTIC STUDIES AT THE DICKINSON SITE, 1970 SEASON. (WHITMAN 1971)	TR116
PRODUCTIVITY	PHYSICAL PROPERTIES OF GRASSLAND SOILS AND THEIR INFLUENCE ON PRIMARY PRODUCTIVITY. (TERWILLIGER 1969)	SS02,65-70
PRODUCTIVITY	PRIMARY PRODUCTIVITY OF THE FESCUE GRASSLAND IN WESTERN MONTANA. (MORRIS AND BRUNNER 1971)	TR113
PRODUCTIVITY	PROBLEMS IN MEASURING GRASSLAND PRODUCTIVITY. (JAMESON 1970)	SS07,58
PROFILES	DISTRIBUTION OF MICROORGANISMS IN PAWNEE SITE SOIL PROFILES. (MAYEUX AND JONES 1970)	SS07,112-120
PRONGHORN	METABOLIC STUDIES OF PRONGHORN ANTELOPE. (NAGY, ET. AL. 1971)	TR088
PRONGHORN	PRONGHORN ANTELOPE FIELD FOOD CONSUMPTION STUDIES. (NAGY AND HOOVER 1971)	TR087
PRONGHORN	WATER KINETICS IN PRONGHORN ANTELOPE. (WESLEY, ET. AL. 1969)	OL007
PRONGHORN	ENERGY-FLUX AND WATER KINETICS IN YOUNG PRONGHORN ANTELOPE. (WESLEY, ET. AL. 1970)	OL040
PRONGHORN	WATER KINETICS IN PRONGHORN ANTELOPE. (WESLEY, ET. AL. 1969)	OL039
PROPERTIES	PHYSICAL PROPERTIES OF GRASSLAND SOILS AND THEIR INFLUENCE ON PRIMARY PRODUCTIVITY. (TERWILLIGER 1969)	SS02,65-70
PROPERTIES	SOME HYDROLOGIC AND PHYSICAL PROPERTIES OF THE MAJOR SOIL TYPES ON THE PAWNEE INTENSIVE SITE. (VAN HAVEREN, GALBRAITH 1971)	TR115
PROPOSAL	PROPOSAL FOR A CELLULOSE DECOMPOSITION STUDY AT THE PAWNEE SITE. (CLARK 1969)	AR69-2572.3
PROPOSAL	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	RP67

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PSYCHROMETRY	PSYCHROMETRY IN WATER RELATIONS RESEARCH: A REVIEW. (VAN HAVEREN 1971)	TR132
PWNEE	PWNEE: A GRASSLAND ECOSYSTEM MODEL. (BLEDSOE, ET. AL. 1971)	TR064
QUANTITATIVE	A QUANTITATIVE ECOLOGY OF THE JORNADA EXPERIMENTAL RANGE. (HERBEL, ET. AL. 1970)	SS06I,133-177
QUANTITATIVE	ASPECTS OF QUANTITATIVE TRAINING IN THE NATURAL RESOURCE SCIENCES. (VAN DYNE 1971)	OL018
QUANTITY	MEASURING QUANTITY AND QUALITY OF THE DIET OF LARGE HERBIVORES. (VAN DYNE 1969)	OL032
RAPID	A RAPID METHOD FOR WASHING OF ROOTS. (LAUENROTH AND WHITMAN 1971)	OL013
RAPTORS	DIURNAL RAPTORS ON THE PAWNEE SITE. (RYDER 1969)	TR026
RATE	HERBAGE GROWTH RATE, FORAGE INTAKE, AND FORAGE QUALITY IN 1970 ON HEAVILY AND LIGHTLY GRAZED BLUE GRAMA PASTURES. (DYCK AND BEMENT 1971)	TR094
RATES	ASSIMILATION RATES OF SMALL MAMMAL HERBIVORES. (HANSEN AND CAVENDER 1970)	TR051
RATES	CONSUMPTION AND METABOLIC RATES OF SOME LEAF-EATING, CHEWING ARTHROPODS: A SUMMARIZE D LITERATURE REVIEW. (MITCHELL 1971)	TR118
RATES	METABOLIC COMPONENTS OF CATTLE UNDER LIGHT AND HEAVY RATES OF STOCKING IN 1970. (HYDER, ET. AL. 1971)	TR128
REARED	CLOSTRIDIUM PERFRINGENS ENTEROTOXEMIA IN HARD REARED ANTELOPE. (NAGY, ET. AL. 1969)	OL001
REBIRTH	PRAIRIE REBIRTH. (MOIR 1968)	OL002
RECIPROCAL	RECIPROCAL INFLUENCES BETWEEN DOMESTIC ANIMALS AND OTHER COMPONENTS OF SEMI-DESERT EC OSYSTEMS. (HOUSTON 1970)	SS06I,178-190
REGIME	THE FEEDING REGIME OF GRANIVOROUS BIRDS IN SHORTGRASS PRAIRIE OF COLORADO. (BALDWIN 1970)	OL021
RELATED	SOME OBSERVATIONS ON FOREIGN GRASSLAND AND RELATED RESEARCH: APRIL-JULY, 1970 VAN DY NE TRIP REPORT. (VAN DYNE 1970)	TR057
RELATED	SPATIAL DISTRIBUTION AND SUCCESSIONAL STATE OF GRASSLAND VEGETATION RELATED TO GRAZIN G INTENSITY TREATMENTS. (MITCHELL 1971)	TR101
RELATING	DATA COLLECTED ON THE PAWNEE SITE RELATING TO WESTERN HARVESTER ANT AND INSECT PREDAT ORS AND PARASITES, 1970. (LAVIGNE, ET. AL. 1971)	TR107
RELATIONS	CLIMATE-PLANT RELATIONS AFFECTING SEMI-DESERT GRASSLAND HYDROLOGY. (COLLINS 1970)	SS06I,100-118
RELATIONS	PSYCHROMETRY IN WATER RELATIONS RESEARCH: A REVIEW. (VAN HAVEREN 1971)	TR132
RELATIONS	DIETS AND ENERGY RELATIONS OF JACKRABBITS AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	AR69-2562
RELATIONSHIP	ANALYSIS OF PLANT PATTERN, DISTRIBUTION AND RELATIONSHIP TO ENVIRONMENTAL PROCESSES. (FISSER AND LESHER 1969)	AR69-2553.1
RELATIONSHIPS	COMPETITIVE RELATIONSHIPS AMONG HERBACEOUS GRASSLAND PLANTS. (RISSER 1969)	OL031
RELATIONSHIPS	SOIL NUTRIENT-PLANT NUTRIENT RELATIONSHIPS AT THE PAWNEE SITE. (DITTBERNER 1971)	TR122
RELATIONSHIPS	PLANT PATTERN AND DISTRIBUTION IN ECOSYSTEMS AND RELATIONSHIPS TO FUNCTION. (FISSER 1969)	SS02,183-196
RELATIONSHIPS	COMPETITIVE RELATIONSHIPS AMONG HERBACEOUS PLANTS AND THEIR INFLUENCES ON THE ECOSYST EM FUNCTION IN GRASSLANDS. (RISSER 1969)	SS02,153-171
RELATIONSHIPS	DIETARY AND ENERGY RELATIONSHIPS OF JACKRABBITS AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	TR014
RELATIVE	RELATIVE DRY WEIGHT ESTIMATES IN DIETS OF HERBIVORES BY THE MICROSCOPIC METHOD, AND S MALL MAMMAL BIOMASS ESTIMATION AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	AR69-2562.1
REMOTE	A FIELD LIGHT QUALITY LABORATORY--INITIAL EXPERIMENT: THE MEASUREMENT OF PERCENT OF FUNCTIONING VEGETATION IN GRASSLAND AREAS BY REMOTE SENSING METHODOLOGY. (PEARSON, ET. AL. 1971)	TR090
RENESTING	RENESTING BY BARN OWLS AND GREAT HORNED OWLS. (MARTI 1969)	OL030
REPLACEMENT	REPLACEMENT OF NATIVE COMMUNITIES WITH INTRODUCED COMMUNITIES AND ITS IMPACT ON ECOSY STEM FUNCTION. (EVERSON 1969)	AR69-2552.2
REPLACEMENT	REPLACEMENT OF NATIVE PLANT COMMUNITIES WITH INTRODUCED COMMUNITIES AND ITS IMPACT ON ECOSYSTEM FUNCTION. (EVERSON 1969)	SS02,261-267
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REQUIREMENTS	LIFE HISTORY, FOOD HABITS, HABITAT REQUIREMENTS, AND POPULATION DYNAMICS OF SMALL HER BIVORES ON SEMI-DESERT GRASSLANDS. (LAYCOCK 1970)	SS06I,198-212
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SIGMODON	BIBLIOGRAPHY ON THE SPECIES AND GENUS SIGMODON (CRICETIDAE, RODENTIA). (SAVIC AND GOLLEY 1971)	TR129
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SIMULATION	SIMULATION TECHNIQUES IN WILDLIFE HABITAT MANAGEMENT. (GILES AND SNYDER 1970)	SS05,23-49
SIMULATION	SIMULATION TECHNIQUES IN FOREST-RANGE MANAGEMENT. (CLIFFORD AND CURRIE 1970)	SS05,17-22
SMALL-HERBIVOROUS-MAMMAL	A REPORT ON INITIAL SMALL-HERBIVOROUS-MAMMAL MODELLING EFFORTS. (GROSS AND WALTERS 1970)	SS07,190
SMALL-HERBIVOROUS-MAMMAL	SUMMARY REPORT ON INITIAL SMALL-HERBIVOROUS-MAMMAL MODELING EFFORTS. (GROSS AND WALTERS 1970)	TR004
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SOIL	DISTRIBUTION OF MICROORGANISMS IN PAWNEE SITE SOIL PROFILES. (MAYEUX AND JONES 1970)	SS07,112-120

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SOIL	THE FUNCTION OF SOIL FAUNA IN GRASSLAND ECOSYSTEMS. (PARIS 1969)	SS02,331-360
SOIL	SOIL DECOMPOSERS. (ALEXANDER 1969)	SS02,403-409
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SOIL	SOIL NITROGEN STUDIES. (REUSS 1969)	AR69-2542.1
SOIL	SOIL MACRO-ARTHROPOD SPECIES AND THEIR DISTRIBUTION AND ABUNDANCE IN THE GRASSLAND BIOME. (LLOYD 1969)	AR69-2571.1
SOILS	MINERALOGY OF REPRESENTATIVE SOILS. (FRANKLIN 1969)	AR69-2542.2
SOILS	BACTERIAL ECOLOGY OF PAWNEE GRASSLAND SOILS. (MAYEUX AND JONES 1969)	AR69-2572.2
SOILS	THE MICROFLORA OF GRASSLAND SOILS AND SOME MICROBIAL INFLUENCES ON ECOSYSTEM FUNCTIONS. (CLARK 1969)	SS02,361-376
SOILS	HYDROLOGY AND WATER BALANCE OF SEMI-DESERT SOILS. (COOPER 1970)	SS06I,119-128
SOILS	SOILS OF THE GRASSLAND BIOME SITES. (REUSS 1971)	SS10,35-40
SOILS	PHYSICAL PROPERTIES OF GRASSLAND SOILS AND THEIR INFLUENCE ON PRIMARY PRODUCTIVITY. (TERWILLIGER 1969)	SS02,65-70
SOILS	MINERALOGY OF REPRESENTATIVE SOILS AT THE PAWNEE SITE. (FRANKLIN 1969)	TR030
SOILS	BACTERIAL ECOLOGY OF GRASSLAND SOILS, PAWNEE SITE. (MAYEUX AND JONES 1969)	TR022
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STEERS	BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF STEERS GRAZING LIGHT, MEDIUM, AND HEAVY USE SHORTGRASS RANGE. (RICE AND VAVRA 1969)	TR012
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STRESS	HERBAGE DYNAMICS ON THE PAWNEE SITE: ABOVEGROUND AND BELOWGROUND HERBAGE DYNAMICS ON THE FOUR GRAZING INTENSITY TREATMENTS; AND PRELIMINARY SAMPLING ON THE ECOSYSTEM STRESS SITE. (SIMS, ET. AL. 1971)	TR099
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STRUCTURE	STRUCTURE OF ECOSYSTEM STUDIES ON AN INTERNATIONAL BASIS. (VAN DYNE 1970)	SS07,45-46
STRUCTURE	MODEL STRUCTURE FOR A GRASSLAND ECOSYSTEM. (BLEDSOE AND JAMESON 1969)	SS02,410-437
STRUCTURE	THE GRASSLAND BIOME: A SYNTHESIS OF STRUCTURE AND FUNCTION, 1970. (LEWIS 1971)	SS10,317-387
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, BIOME PROPOSAL 1967. (VAN DYNE 1967)	BP67
STRUCTURE	THE ROLE OF ABIOTIC FACTORS IN THE STRUCTURE AND FUNCTION OF THE GRASSLAND ECOSYSTEM. (BURZLAFF 1969)	SS02,117-123
STRUCTURE	THE IMPACT OF DOMESTIC ANIMALS ON THE FUNCTION AND STRUCTURE OF GRASSLAND ECOSYSTEMS. (HYDER 1969)	SS02,243-260

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STRUCTURE	SOME INFLUENCES OF VEGETATION STRUCTURE ON ENERGY-FLUX, WATER-FLUX, AND NUTRIENT-FLUX IN GRASSLAND ECOSYSTEMS. (KNIGHT 1969)	SS02,197-220
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.51 . (VAN DYNE 1969)	PR69-8.51
STRUCTURE	AN ANALYSIS OF VEGETATION STRUCTURE ON THE PAWNEE GRASSLAND, WITH SUBSEQUENT EVALUATI ONS OF THE INFLUENCE OF STRUCTURE ON ECOSYSTEM FUNCTION. (KNIGHT 1969)	AR69-2553.2
STRUCTURE	AN ANALYSIS OF VEGETATION STRUCTURE ON THE PAWNEE GRASSLAND, WITH SUBSEQUENT EVALUATI ONS OF THE INFLUENCE OF STRUCTURE ON ECOSYSTEM FUNCTION. (KNIGHT 1969)	AR69-2553.2
STRUCTURE	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.6. (VAN DYNE 1971)	PR71-2.6
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-5. (VAN DYNE 1969)	PR69-5.
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-8. (VAN DYNE 1970)	PR70-8
STRUCTURE	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-4.4. (VAN DYNE 1971)	PR71-4.4
STRUCTURE	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.7. (VAN DYNE 1971)	PR71-2.7
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.5. (VAN DYNE 1970)	PR70-2.5
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.53 . (VAN DYNE 1969)	PR69-8.53
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.6. (VAN DYNE 1970)	PR70-2.6
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.52 . (VAN DYNE 1969)	PR69-8.52
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-6. (VAN DYNE 1969)	PR69-6.
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-4. (VAN DYNE 1969)	PR69-4.
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-0. (VAN DYNE 1969)	PR69-0
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-9. (VAN DYNE 1969)	PR69-9
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-2.4. (VAN DYNE 1970)	PR70-2.4
STRUCTURE	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1970-4.1. (VAN DYNE 1970)	PR70-4.1
STRUCTURE	ANALYSIS OF STRUCTURE, FUNCTION, AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS RE PORT 1971-6. (VAN DYNE 1971)	PR71-6
STRUCTURE	ANALYSIS OF STRUCTURE AND FUNCTION OF GRASSLAND ECOSYSTEMS, PROGRESS REPORT 1969-8.4. (VAN DYNE 1969)	PR69-8.4
STRUCTURE	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.4. (VAN DYNE 1971)	PR71-2.4
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SURVEY	SMALL MAMMAL SURVEY ON THE BISON, BRIDGER, COTTONWOOD, DICKINSON, AND OSAGE SITES. (HOFFMANN, ET. AL. 1971)	TR109
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SWEEP	SAMPLING INSECT POPULATIONS BY SWEEP NET ON THE PAWNEE SITE. (THATCHER, ET. AL. 1970)	TR050

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SYMPOSIUM--A	GRASSLAND BIOME GRADUATE STUDENT SYMPOSIUM--A REVIEW. (WRIGHT AND SMITH 1970)	TR059
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SYSTEMS	GRASSLANDS MANAGEMENT, RESEARCH, AND TRAINING VIEWED IN A SYSTEMS CONTEXT. (VAN DYNE 1969)	SS03,1-39
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SYSTEMS	SOME ANALYTICAL AND OPERATIONAL APPROACHES TO DEVELOPING DYNAMICMODELS OF ECOLOGICAL SYSTEMS. (VAN DYNE, ET. AL. 1971)	OL019
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SYSTEMS	A SYSTEMS APPROACH TO GRASSLANDS. (VAN DYNE 1970)	OL034
TAXONOMIC	TAXONOMIC SUPPORT FOR THE GRASSLAND BIOME STUDY. (KLEIN 1969)	AR69-2510
TECHNIQUES	SOME OPTIMIZATION TECHNIQUES AND PROBLEMS IN THE NATURAL RESOURCE SCIENCES. (VAN DYNE, ET. AL. 1970)	OL036
TECHNIQUES	SIMULATION TECHNIQUES IN WILDLIFE HABITAT MANAGEMENT. (GILES AND SNYDER 1970)	SS05,23-49
TECHNIQUES	AN EXAMPLE OF OPTIMIZATION TECHNIQUES IN LAND MANAGEMENT: THE RESOURCE ALLOCATION MOD EL. (PRICE 1970)	SS05,89-100
TECHNIQUES	SIMULATION TECHNIQUES IN FOREST-RANGE MANAGEMENT. (CLIFFORD AND CURRIE 1970)	SS05,17-22
TECHNIQUES	AN EXAMPLE OF OPTIMIZATION TECHNIQUES IN LAND MANAGEMENT: THE ELDORADO MODEL. (BELL 1970)	SS05,75-87
TECHNIQUES	TECHNIQUES IN MEASURING BIOMASS OF PRODUCERS. (VAN DYNE, ET. AL. 1970)	SS07,62-64
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TRACERS	WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTIONING BY CATTLE. (HYDER 1969)	AR69-2561.1
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TRAINING	IMPLEMENTING THE ECOSYSTEM CONCEPT IN TRAINING IN NATURAL RESOURCE SCIENCES. (VAN DYNE 1969)	OL033
TRAINING	GRASSLANDS MANAGEMENT, RESEARCH, AND TRAINING VIEWED IN A SYSTEMS CONTEXT. (VAN DYNE 1969)	SS03,1-39
TRANSLOCATION	PRELIMINARY RESULTS OF GROWTH CHARACTERISTICS OF BUFFALOGRASS, BLUE GRAMA, AND WESTER N WHEATGRASS, AND METHODOLOGY FOR TRANSLOCATION STUDIES USING 14C AS A TRACER. (KNIEVEL AND SCHMER 1971)	TR086
TRANSLOCATION	THE MOBILITY AND TRANSLOCATION OF NITROGEN IN GRASS PLANTS. (PORTER 1969)	AR69-2552.3
TREATMENTS	SPATIAL DISTRIBUTION AND SUCCESSIONAL STATE OF GRASSLAND VEGETATION RELATED TO GRAZIN G INTENSITY TREATMENTS. (MITCHELL 1971)	TR101
TREATMENTS	HERBAGE DYNAMICS ON THE PAWNEE SITE: ABOVEGROUND AND BELOWGROUND HERBAGE DYNAMICS ON THE FOUR GRAZING INTENSITY TREATMENTS: AND PRELIMINARY SAMPLING ON THE ECOSYSTEM STR ESS SITE. (SIMS, ET. AL. 1971)	TR099
TREATMENTS	STUDIES OF POPULATIONS OF ADULTS AND IMMATURE INSECTS AND MITES FROM TWO TREATMENTS A T COTTONWOOD, SOUTH DAKOTA. (MCDANIEL 1971)	TR112
TROPHIC	EXAMPLES OF TROPHIC LEVEL AND TOTAL ECOSYSTEM MODELS. (VAN DYNE 1970)	SS07,191-198
TURNOVER	METABOLIC COMPONENTS OF CATTLE: WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTITIONING BY CATTLE. (HYDER, ET. AL. 1969)	TR010
TURNOVER	WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTIONING BY CATTLE. (HYDER 1969)	AR69-2561.1
UNGRAZED	HERBAGE DYNAMICS AND NET PRIMARY PRODUCTION IN CERTAIN UNGRAZED AND GRAZED GRASSLANDS IN NORTH AMERICA. (SIMS AND SINGH 1971)	SS10,59-124
UNGRAZED	COMPARISONS OF ABOVEGROUND PLANT BIOMASS ON UNGRAZED PASTURES VS. PASTURES GRAZED BY LARGE HERBIVORES, 1970 SEASON. (GRANT 1971)	TR131

SIGNIFICANT-WORD	ARTICLE	REFERENCE
USDA	MEMORANDA OF AGREEMENT AND PROCEDURES FOR WORKING ON FEDERAL LANDS OF THE USDA. (JAMESON AND NELL 1970)	TR008
UTILIZATION	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-4.4. (VAN DYNE 1971)	PR71-4.4
UTILIZATION	ANALYSIS OF STRUCTURE, FUNCTION, AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS RE PORT 1971-6. (VAN DYNE 1971)	PR71-6
UTILIZATION	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.6. (VAN DYNE 1971)	PR71-2.6
UTILIZATION	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.4. (VAN DYNE 1971)	PR71-2.4
UTILIZATION	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.5. (VAN DYNE 1971)	PR71-2.5
UTILIZATION	ANALYSIS OF STRUCTURE, FUNCTION AND UTILIZATION OF GRASSLAND ECOSYSTEMS, PROGRESS REP ORT 1971-2.7. (VAN DYNE 1971)	PR71-2.7
VARIATION	OPUNTIA CLUMP SIZE VARIATION ON THE SHORTGRASS PLAINS, PAWNEE SITE, NUNN, COLORADO. (LESTER AND FISSER 1970)	OL014
VARIATION	THE NATURE AND SIGNIFICANCE OF ECO-GENETIC VARIATION IN ECOSYSTEMS. (WARD 1969)	SS02,148-152
VEGETATION	DYNAMICS OF STANDING DEAD VEGETATION ON THE SHORTGRASS PLAINS. (BEMENT 1969)	SS02,221-224
VEGETATION	SOME INFLUENCES OF VEGETATION STRUCTURE ON ENERGY-FLUX, WATER-FLUX, AND NUTRIENT-FLUX IN GRASSLAND ECOSYSTEMS. (KNIGHT 1969)	SS02,197-220
VEGETATION	SOME MEASUREMENTS OF VEGETATION STRUCTURE ON THE PAWNEE GRASSLAND, 1970. (KNIGHT 1971)	TR072
VEGETATION	A FIELD LIGHT QUALITY LABORATORY--INITIAL EXPERIMENT: THE MEASUREMENT OF PERCENT OF FUNCTIONING VEGETATION IN GRASSLAND AREAS BY REMOTE SENSING METHODOLOGY. (PEARSON, ET. AL. 1971)	TR090
VEGETATION	SPATIAL DISTRIBUTION AND SUCCESSIONAL STATE OF GRASSLAND VEGETATION RELATED TO GRAZIN G INTENSITY TREATMENTS. (MITCHELL 1971)	TR101
VEGETATION	AN ANALYSIS OF VEGETATION STRUCTURE ON THE PAWNEE GRASSLAND, WITH SUBSEQUENT EVALUATI ONS OF THE INFLUENCE OF STRUCTURE ON ECOSYSTEM FUNCTION. (KNIGHT 1969)	AR69-2553.2
VEGETATION	THE MEASUREMENT OF PERCENT OF FUNCTIONING VEGETATION IN GRASSLAND AREAS. (MILLER 1969)	AR69-2520
VIEWED	GRASSLANDS MANAGEMENT, RESEARCH, AND TRAINING VIEWED IN A SYSTEMS CONTEXT. (VAN DYNE 1969)	SS03,1-39
VITAE	CURRICULUM VITAE OF SCIENTISTS TO PARTICIPATE IN THE U.S. IBP GRASSLAND BIOME STUDIES PROPOSED FOR 1972 AND 1973. (WRIGHT 1971)	TR125
WATER	PSYCHROMETRY IN WATER RELATIONS RESEARCH: A REVIEW. (VAN HAVEREN 1971)	TR132
WATER	HYDROLOGY AND WATER BALANCE OF SEMI-DESERT SOILS. (COOPER 1970)	SS06I,119-128
WATER	METABOLIC COMPONENTS OF CATTLE: WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTITIONING BY CATTLE. (HYDER, ET. AL. 1969)	TR010
WATER	MEASUREMENT OF THE ENERGY STATUS OF WATER IN A GRASSLAND ECOSYSTEM. (VAN HAVEREN 1971)	TR076
WATER	SOIL WATER STUDY OF A SHORTGRASS PRAIRIE ECOSYSTEM, PAWNEE SITE. (GALBRAITH 1969)	TR006
WATER	WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTIONING BY CATTLE. (HYDER 1969)	AR69-2561.1
WATER	WATER KINETICS IN PRONGHORN ANTELOPE. (WESLEY, ET. AL. 1969)	OL007
WATER	WATER KINETICS IN PRONGHORN ANTELOPE. (WESLEY, ET. AL. 1969)	OL039
WATER	ENERGY-FLUX AND WATER KINETICS IN YOUNG PRONGHORN ANTELOPE. (WESLEY, ET. AL. 1970)	OL040
WATER-FLUX	SOME INFLUENCES OF VEGETATION STRUCTURE ON ENERGY-FLUX, WATER-FLUX, AND NUTRIENT-FLUX IN GRASSLAND ECOSYSTEMS. (KNIGHT 1969)	SS02,197-220
WATER-SOLUBLE	METABOLIC COMPONENTS OF CATTLE: WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTITIONING BY CATTLE. (HYDER, ET. AL. 1969)	TR010
WATER-SOLUBLE	WATER-SOLUBLE TRACERS FOR DETERMINING WATER TURNOVER AND PARTIONING BY CATTLE. (HYDER 1969)	AR69-2561.1
WATERSHED	THE DESIGN OF A SPATIAL DATA FRAMEWORK, CENTRAL BASIN WATERSHED, PAWNEE SITE. (OLIVER AND MILLER 1971)	TR089
WEIGHT	A STUDY OF THE WEIGHT ESTIMATION METHOD OF BOTANICAL ANALYSIS. (FRANCIS, ET. AL. 1971)	TR117
WEIGHT	DRY WEIGHT BIOMASS DATA FOR FOUR ABUNDANT GRASSHOPPER SPECIES OF THE PAWNEE SITE. (VANHORN 1969)	TR019

SIGNIFICANT-WORD	ARTICLE	REFERENCE
WEIGHT	RELATIVE DRY WEIGHT ESTIMATES IN DIETS OF HERBIVORES BY THE MICROSCOPIC METHOD, AND SMALL MAMMAL BIOMASS ESTIMATION AT THE PAWNEE SITE. (HANSEN, ET. AL. 1969)	AR69-2562.1
WEIGHT	METHODS OF ESTIMATING DRY WEIGHT COMPOSITION IN DIETS OF STEERS. (FREE, ET. AL. 1971)	OL011
WEIGHTS	ESTIMATING DRY WEIGHTS OF FOOD PLANTS IN FECES OF HERBIVORES. (FREE, ET. AL. 1970)	OL003
WHEATGRASS	PRELIMINARY RESULTS OF GROWTH CHARACTERISTICS OF BUFFALOGRASS, BLUE GRAMA, AND WESTERN WHEATGRASS, AND METHODOLOGY FOR TRANSLOCATION STUDIES USING 14C AS A TRACER. (KNIEVEL AND SCHMER 1971)	TR086
WILDLIFE	SIMULATION TECHNIQUES IN WILDLIFE HABITAT MANAGEMENT. (GILES AND SNYDER 1970)	SS05,23-49
WOODY	THE NATURE AND IMPORTANCE OF COMPETITION BETWEEN WOODY AND HERBACEOUS PLANTS IN A GRASSLAND ECOSYSTEM. (SHUBERT 1969)	SS02,172-182
WORKSHOP	RESULTS OF WORKSHOP GROUPS. (WRIGHT AND VAN DYNE 1970)	SS06IT,1-69

ABSTRACTS

Technical Reports

TR001 Jameson, D. A. [Coordinator]. 1969. General description of the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 1. Colorado State Univ., Fort Collins. 32 p.

Site description, Soil types, Pawnee, Plant checklist, Mammal checklist, Bird checklist

The Pawnee Site, the Intensive Site location of the Grassland Biome, lies within the western division of the Pawnee National Grasslands which is administered by the U.S. Forest Service. At the western edge of the Pawnee National Grasslands lies the Central Plains Experimental Range operated by the Agricultural Research Service. Intensive studies requiring careful experimental control are conducted on the Central Plains Experimental Range; more extensive studies requiring a great deal of space but less control are conducted on the Pawnee National Grasslands.

TR002 Bartos, D. and J. Hughes. 1969. Preliminary methodology and results for root biomass sampling on the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 2. Colorado State Univ., Fort Collins. 20 p.

Pawnee, Belowground plant biomass, Grazing influence

Biweekly sampling of root biomass, organic matter, and crown material was conducted at the Pawnee Site during the summer of 1969. The biomass data collected are presented here with means and standard deviations. These data will be utilized to determine future methods of sampling.

TR003 Swartzman, G. L. 1969. A preliminary bird population dynamics and biomass model. U.S. IBP Grassland Biome Tech. Rep. No. 3. Colorado State Univ., Fort Collins. 16 p.

Consumer model, Bird model, Lark Bunting

In this paper a preliminary model for the population and biomass change over time is given for bird populations. The interaction between biologist and modeller in the development of the model and its parameters is emphasized. The model consists of two constant coefficient differential equations. The output of the model, applied to the Lark Bunting, is compared with results of field experiments. Discussions of further extensions of the model as well as present difficulties are also included.

TR004 Gross, J. E. and C. J. Walters. 1970. Summary report on initial small-herbivorous-mammal modelling efforts, Pawnee Site, Grassland Biome. U.S. IBP Grassland Biome Tech. Rep. No. 4. Colorado State Univ., Fort Collins. 57 p.

Consumer model, Mammal model, Pawnee

The small herbivorous mammals are a conspicuous element in the grassland ecosystem and presumably exert a significant role in the functioning of the ecosystem. The small mammal modelling effort has as a primary objective the delineation of this role. Small herbivorous mammals form one of several arbitrarily-separated groups which have been designated as primary consumers on the Pawnee Site of the Grassland Biome. The small-herbivorous-mammal complex on the Pawnee Site is made up by about 25-30 species, ranging in size from 40 g mice, through 1,000 g prairie dogs, to 3,000 g jackrabbits. Eleven of these 25-30 small herbivores have been selected for study, the selection being made on the basis of estimates and opinions of relative densities, with the hope that the majority of the small mammal biomass will be included in a model simulating the demographic behavior of the 11 species. Eight of the species are rodents, and three are rabbits or hares.

TR005 Smith, F. M. and W. D. Striffler. 1969. Pawnee Site microwatersheds: Selection description and instrumentation. U.S. IBP Grassland Biome Tech. Rep. No. 5. Colorado State Univ., Fort Collins. 29 p.

Microwatersheds, Pawnee, Site description

Preliminary criteria for selecting the locations of microwatersheds on the Pawnee Site were grazing treatments, size, soils, vegetation, slope, aspect, and slope position. Vegetation composition similarities among the proposed locations were also compared using the Sorenson index of similarity. In general, the eight microwatersheds selected provide a reasonable basis for comparing grazing treatments on Ascalon soils. These watersheds are instrumented to automatically measure precipitation, runoff, soil water, and soil temperature. Data from each microwatershed site are telemetered via a cable to a central data collection system in the headquarters building at the Pawnee Site.

TR006 Galbraith, A. F. 1969. Soil water study of a shortgrass prairie ecosystem, Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 6. Colorado State Univ., Fort Collins. 51 p.

Soil water, Evapotranspiration, Pawnee

Soil water instrumentation at the microwatersheds on the Pawnee Site are described in detail. The instrument used is a neutron probe and its calibration and accuracy are discussed. Soil samples are collected and analyzed to determine the textural composition, bulk density, pore space distribution, and water retention characteristics. Methods for the studies of soil water balance, soil water depletion, soil water spatial variation, and evapotranspiration are discussed at length. The data will ultimately be utilized to develop a microwatershed model and a general hydrologic model.

TR007 Reuss, J. O. and P. W. Copley. 1969. Soil nitrogen investigations, Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 7. Colorado State Univ., Fort Collins. 13 p.

Nitrogen fixation, Pawnee

The acetylene reduction technique was used to measure rates of nitrogen fixation by free-living organisms, presumably bacteria, on soil-plant cores from the Pawnee Site. At field capacity moisture levels fixation was negligible. Slightly higher rates were observed under saturated or artificially anaerobic conditions. Rates of fixation in these systems ranged from 1 to 5 g/ha/day. Even the highest figure would represent only 150 g/month. Even in the buffalo grass sod areas, where water collects, the soil is not continually saturated. Also, during a substantial portion of the year, low temperatures severely restrict biological processes. Thus it seems unlikely that more than a few hundred grams/hectare/year are being fixed by this process, while rates on upland areas probably are even lower. Very high levels of energy-supplying material, coupled with anaerobic conditions, result in substantial rates, but the efficiency of conversion is low. On the whole, these data indicate that free-living bacterial fixation is probably not an important source of nitrogen on the grassland.

Nodulation has not been observed on the common range legumes in the area, nor has fixation been detected by the acetylene reduction method. However, observations are limited and the data is not sufficient to draw conclusions concerning the role of symbiotic fixation.

TR008 Jameson, D. A. and L. G. Nell. 1970. Memoranda of agreement and procedures for working on federal lands of the USDA. U.S. IBP Grassland Biome Tech. Rep. No. 8. Colorado State Univ., Fort Collins. 53 p.

Agreements

This technical report contains examples of agreements, contracts and procedures, and the resulting official paperwork that outlines the cooperation between Colorado State University, the United States Department of Agriculture and individual investigators, as part of the International Biological Program, Grassland Biome studies.

TR009 Fisser, H. G. 1969. Preliminary report of methodology and results for analysis of plant pattern subproject research on the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 9. Colorado State Univ., Fort Collins. 65 p.

Plant pattern, Cover, Prickly pear, Dispersion, Pawnee, Plant cover

Distributional forms and dispersion characteristics of *Opuntia polyacantha* were examined in areas subjected to three grazing treatment rates (light, medium, and heavy). Determinations of non-randomness were made from comparisons of observed numbers of individuals per quadrat to the expected number per quadrat derived from a Poisson series. Frequency data were obtained from transects of 256 contiguous sq dm quadrats in 30 m × 30 m study plots within each grazing treatment. The analysis of variance technique applied to the frequency data gave an estimate of the clump sizes within each treatment. Mean area of clumps for the light, medium and heavy grazing treatments were: 4, 16, and 128; 4 and 128; and 8, 32, and 128 dm, respectively.

TR010 Hyder, D. N., K. L. Knox, and R. E. Bement. 1969. Metabolic components of cattle: Water-soluble tracers for determining water turnover and partitioning by cattle, Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 10. Colorado State Univ., Fort Collins. 32 p.

Pawnee, Urine output, Egestion, Cattle excretion, Water turnover, Excretion

The objective of the project on water-soluble tracers for determining water turnover and partitioning by cattle is to determine the energy and nutrient components associated with the water components consumed and excreted by cattle. For example, if fecal water output can be determined, the dry matter and energy concentrations can be added to arrive at total daily amounts.

^{14}C labeled polyethylene glycol (PEG) was used to estimate fecal output, lithium (Li) was used to estimate urine output, and tritiated water ($^{3}H_2O$) was used to estimate total body water and total water turnover. Problems associated with sample collection and tracer extraction had high priority in the initial experiments.

PEG consumed in drinking water is excreted entirely in feces. However, adsorption to organic matter prevents complete recovery, and high concentrations are required for adequate sampling precision. A new extraction procedure that attains 100% recovery has been developed, and labelling with ^{14}C permits the use of very low concentrations. Since we prefer non-radioactive tracers for field studies, three non-radioactive compounds were tested as tracers of fecal output. These compounds were not satisfactory because of metabolic conversions and adsorption losses.

Li is excreted almost entirely in urine and can be used as a tracer of urine output. However, techniques for recovering Li from both urine and feces still require improvement.

Tritiated water is excreted in vapor as well as liquid phases of water, and has been used widely to determine total body water and total water turnover. Since better sampling procedures are needed, we developed equipment for collecting respired water, which requires no purification, and compared respired water with that obtained from saliva, blood, and urine. Tritium concentrations were the same in all water sources. Therefore, field sampling can be designed to accomodate the equipment available and the objectives of a study.

In future work, we will estimate urine and fecal outputs of cattle on pastures stocked heavily (23E) and lightly (23W), as well as to continue studies on the development of water-soluble tracers. For example, fecal output of fistulated steers was measured by total collection (Tech. Rep. No. 12). Fecal output by the heifers used to apply the grazing routines was not measured. Urine output was not measured for any animal. Therefore, using water-soluble tracers to estimate urine and fecal outputs can make the work easier and the overall determination of bioenergetics more complete. The work in 1970 will determine sampling precision and accuracy, if the radioactive tracers are given safety clearance.

TR011 Rice, R. W., D. R. Cundy, and P. R. Weyerts. 1969. A comparison of the esophageal fistula with rumen samples for the determination of the botanical and chemical composition of the diet of herbivores. U.S. IBP Grassland Biome Tech. Rep. No. 11. Colorado State Univ., Fort Collins. 13 p.

Fistula, Rumen, Food composition, Sheep, Water turnover, Mammals

Bifistulated wethers (esophageal and rumen) were used to collect samples of the diet while grazing shortgrass native range. The esophageal and rumen grab samples were different botanically. There were fewer forbs and more grasses found in rumen samples. The nitrogen content of rumen samples was higher than that of esophageal samples. Rumen samples were lower in in vitro dry matter digestibility than esophageal samples. Rumen grab samples cannot be expected to yield quantitative botanical information on grazing animals diet or on nitrogen content and dry matter digestibility.

TR012 Rice, R. W. and M. Vavra. 1969. Botanical species of plants eaten and intake of steers grazing light, medium, and heavy use shortgrass range. U.S. IBP Grassland Biome Tech. Rep. No. 12. Colorado State Univ., Fort Collins. 18 p.

Steers, Fistula, Food composition, Ingestion, Digestion, Mammals

The purpose of this study was to measure the botanical species eaten, the dietary nitrogen content, and the intake of grazing steers as affected by season and intensity of use of shortgrass range lands. The botanical species identified in the esophageal samples of steers constitute 10 grasses, 10 forbs, 1 sedge, and 2 shrubs. Grasses made up the largest proportion of the diet. Dry matter digestibility was lower on the heavy use pasture while it did not differ much among light and medium use areas. The steers grazing the medium use pasture excreted the greatest amount of fecal material while those on the heavy use pastures expelled the least. The steers on the medium use pasture ate more and had a slightly more digestible diet while those grazing the heavy use pastures ate less total diet, which was also lower in digestibility, than those from the other two grazing intensities. The diets of steers grazing heavy and medium use pastures were higher in protein content than in light use pastures for the season.

TR013 Nagy, J. G., K. L. Knox, and D. E. Wesley. 1969. Progress report IBP antelope project, Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 13. Colorado State Univ., Fort Collins. 18 p.

Pawnee, Pronghorn, Antelope, Water turnover, Energy flow, Ingestion

Energy flow trials with four pronghorn antelope produced results similar to those described for other ruminants, with the possible exception of total heat production and fasting metabolic rate. The increased heat production may have been due to the higher metabolism of young animals. The fasting metabolic rates were higher than the interspecific mean of 70 $kcal/kg^{3/4}/day$ (Kleiber 1961); similar results occurred with other wild ruminants.

Results obtained on water kinetics of antelope show a higher percent body water and flux in females than in males. Data also indicate that pronghorn antelope, under the conditions tested, have a slightly higher body water content than other species examined in other studies. Since pronghorns probably have a lower body fat content than domestic animals, body water content probably would be higher. Water flux in antelope is similar to that in sheep or deer.

TR014 Hansen, R. M., J. T. Flinders, and B. R. Cavender. 1969. Dietary and energy relationships of jackrabbits at the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 14. Colorado State Univ., Fort Collins. 43 p.

Pawnee, Jackrabbit, Sex ratio, Age structure, Food composition

Jackrabbits were collected from roughly a 208 sq mile area on the Pawnee Site on a year-round schedule of monthly collections in the summer and bimonthly collections during the winter. Dietary material was analyzed from the stomach contents through microscopic technique. The sex ratio in the black-tailed jackrabbits was 100 males to 99.34 females, and in the white-tailed jackrabbits 100 males to 100.66 females. A study of the age structure indicated that the two species are somewhat similar in their periods of reproduction. The results reported here also prove that the precocial young of both the species suckle much longer than was previously reported; 10 to 12-week-old white-tailed and 6 to 8-week-old black-tailed jackrabbits had milk in their stomachs. Computer programs were also developed to summarize the aboveground plant biomass for individual jackrabbits and for each species of jackrabbit by collection period, by season, and by annual mean biomass at collection sites. Another program converts frequency of plant species on microscope slides to percentage dry weight in the diets, and determines preference indices and computer similarity indices of various kinds.

TR015 Flake, L. D. 1969. A study of rodents in northeastern Colorado. U.S. IBP Grassland Biome Tech. Rep. No. 15. Colorado State Univ., Fort Collins. 29 p.

Mammals, Rodent, Pocket gopher, Sex ratio, Mammal density, Mortality, Breeding rate, Age structure, Grazing influence

This study was primarily concerned with *Dipodomys ordii luteolus* (Goldman), *Onychomys leucogaster arcticeps* Rhoads, *Peromyscus maniculatus osgoodi* Mearns, and *Spermophilus tridecemlineatus alleni* Merriam. The results indicate that there is no relationship between grazing intensities and number of *O. leucogaster* and *S. tridecemlineatus*. Data for other species are not sufficient to warrant any conclusion.

From late spring to mid-summer of 1969, *S. tridecemlineatus* represented the primary rodent biomass, while in late summer and mid-fall *O. leucogaster* attained this position. Both *O. ordii* and *P. maniculatus* were found in low numbers and never were the primary rodent biomass.

TR016 Gross, J. E. 1969. Jackrabbit demographic and life history studies, Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 16. Colorado State Univ., Fort Collins. 8 p.

Jackrabbit, Life history, Demography, Pawnee, Dispersion, Jackrabbit density, Mammals

Jackrabbit densities are indexed once in the spring and once in the fall. Index values are the average numbers of each species flushed per mile of paced transect on 36 miles of permanently located transects. The range of variation and the maximum values in absolute population size appear to be greater in black-tails than in white-tails. The age structures of black-tails and white-tails follow comparable curves each year and both species showed maximum values of about 70 to 80% juveniles. The distribution of the two species is outlined.

TR017 Bertolin, G. and J. Rasmussen. 1969. Preliminary report on the study of the precipitation on the Pawnee National Grassland. U.S. IBP Grassland Biome Tech. Rep. No. 17. Colorado State Univ., Fort Collins. 34 p.

Pawnee, Precipitation

Preliminary results of a study of the precipitation of the Pawnee National Grasslands are presented. The spatial and time distributions and variations of precipitation are presented. A Markov Chain Probability Analysis is included in the discussion in addition to more classical statistical treatments. Some discussion of other meteorological parameters is included.

TR018 Cavender, B. R. and R. M. Hansen. 1970. The microscope method used for herbivore diet estimates and botanical analysis of litter and mulch at the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 18. Colorado State Univ., Fort Collins. 9 p.

Pawnee, Plant fragment identification

This Technical Report describes the microscopic technique used in the identification of plant fragments in herbivore diets, litter, mulch, and other complex plant species mixtures. This report also shows how to estimate the percentage dry weight each species of plant may contribute in complex mixture.

TR019 Van Horn, D. H. 1969. Dry weight biomass data for four abundant grasshopper species of the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 19. Colorado State Univ., Fort Collins. 6 p.

Grasshopper, Pawnee, Grasshopper biomass, Insects, Insect biomass

Data are presented for the oven-dry weights of adults and juvenile instars of each sex for four species of acridid grasshoppers on the Pawnee Site: *Opeia obscura* Thomas, *Psoloessa texana* Scudder, *Xanthippus corallipes* Haldeman, and *Melanoplus gladstoni* Scudder.

TR020 Lavigne, R. J. and L. E. Rogers. 1970. Effect of insect predators and parasites on grass feeding insects, Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 20. Colorado State Univ., Fort Collins. 38 p.

Pawnee, Ant, Insect food web, Parasites, Predation

The predators included in this study are the robber flies (Asilidae), tiger beetles (Cicindelidae), wolf spiders (Lycosidae), jumping spiders (Salticidae), mantids (Mantidae), sphecid wasps (Sphecidae), and western harvester ants (*Pogonomyrmex occidentalis*). Data presented here are related to the population densities of these predators. An effort also was made to determine type of prey selected, amount consumed and general predatory behavior in relation to the environmental factors present at the study site. A food web is included with this report, showing some of the predator-prey relationships.

TR021 Doxtader, K. G. 1969. Microbial biomass measurements at the Pawnee Site: Preliminary methodology and results. U.S. IBP Grassland Biome Tech. Rep. No. 21. Colorado State Univ., Fort Collins. 16 p.

Bacteria biomass, Fungi biomass, Pawnee, Bacteria, Fungi, Microflora, Microbial biomass

This report describes studies of microbial form and function at the Pawnee Site and includes: (i) direct estimation of microbial biomass in soil and (ii) development of an ATP assay as an indirect measurement of biomass. For both bacteria and fungi there was a decrease in biomass values with increasing soil depth, and the values for both the areas decreased from July to September.

A typical standard curve for the analysis of ATP by the firefly enzyme showed that the method is extremely sensitive and the relation is linear over a wide range of ATP concentrations. This procedure may be satisfactory for the estimation of biomass of soil bacteria.

TR022 Mayeux, J. V. and E. A. Jones. 1969. Bacterial ecology of grassland soils, Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 22. Colorado State Univ., Fort Collins. 13 p.

Pawnee, Bacteria, Bacteria population, Microbial population

The preliminary results of population estimation through plate count on the four major treatments indicated differences in the bacterial population. The bacterial population in the upper layers of soil varied from 10×10^6 to 75×10^6/g soil, and in soils below 40 to 45 cm the values were lower than 10×10^6/g soil.

TR023 Christensen, M. and A. M. Scarborough. 1969. Soil microfungi investigations, Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 23. Colorado State Univ., Fort Collins. 18 p.

Pawnee, Fungi, Grazing influence, Fungi population, Soil physical characteristics, Soil chemical characteristics, Microflora, Microbial population

Fungal propagule density was slightly higher in the heavily grazed area, and there were nearly twice as many high-frequency microfungi in this area as compared to lightly grazed area. The Pawnee Site soil microfungal flora is a distinctive assemblage of a mid- and tallgrass prairie microflora element and a desert mycoflora element. Frequencies and densities of soil-mycoflora isolates and the influence of grazing on coefficients of similarity are reported. Soil physical and soil chemical characteristics are also given.

TR024 Wright, R. G. [Compiler]. 1970. Scientific personnel participating in the Grassland Biome study, June 1968 through January 1970. U.S. IBP Grassland Biome Tech. Rep. No. 24. Colorado State Univ., Fort Collins. 278 p.

Personnel vitae

This report is intended to serve as a directory of all participants active in the U.S. IBP Grassland Biome program between June 1968 and January 1970. The entries contain background information on academic training and professional experience, major interests, professional activities, and publications of the participants.

TR025 Robinson, R. D. 1970. IBP Grasslands Biome budget program. U.S. IBP Grassland Biome Tech. Rep. No. 25. Colorado State Univ., Fort Collins. 10 p.

Budget

The program computes the benefits, indirect costs, subtotals, and totals for budgets pertaining to each of the five hierarchical levels. The indirect funds for each budget are calculated at a given rate according to one of the following three bases: (i) total salaries and wages, (ii) total salaries, wages, and benefits, and (iii) total direct costs less capital.

TR026 Ryder, R. A. 1969. Diurnal raptors on the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 26. Colorado State Univ., Fort Collins. 16 p.

Hawk, Falcon, Raptor, Golden Eagle, Rough-legged Hawk, Swainson's Hawk, Raptor biomass, Eagle

The diurnal raptors (hawks, eagles, and falcons) were censused during routine bird counts and by more extensive counts designed to take into consideration the raptors' large home ranges and low population densities. Population indices (total number of raptors/100 miles of census route) indicated that the Pawnee Site has a greater population of raptors than reported in similar studies in Colorado, Nebraska, and Texas.

The Golden Eagle was most frequently observed (32.6%); the Rough-legged Hawk and the Marsh hawk each accounted for about 20% of the observations.

TR027 Marti, C. D. 1969. Some comparisons of feeding ecology of four species of owls in north-central Colorado. U.S. IBP Grassland Biome Tech. Rep. No. 27. Colorado State Univ., Fort Collins. 21 p.

Owl, Food composition, Owl prey, Predation

Composition of the diet of four species of Owls, viz., Great Horned, Long-eared, Burrowing, and Barn, was determined. Average weights of prey species were estimated and used to calculate the biomass each species contributes to each owl's diet. A list of prey species and biomass data for various prey species are included.

TR028 Giezentanner, J. B. and R. A. Ryder. 1969. Avian distribution and population fluctuations at the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 28. Colorado State Univ., Fort Collins. 29 p.

Pawnee, Lark Bunting, Horned Lark, Meadowlark, Birds, Grazing influence, Bird distribution, Bird production, Bird biomass, Nesting, Bird checklist

Relative abundance of 32 bird species was recorded, the total number varying from zero (December 23, 1968) to 132 (September 1, 1969). On heavily grazed areas the Horned Lark was the most abundant species. In summer, as vegetative cover of certain plots increased, Horned Larks were replaced by Meadowlarks, Brewer's Sparrows, and Lark Buntings. For nesting purposes, Horned Larks and McCown's Longspurs used the heavily summer-grazed plots extensively while nests of Meadowlarks, Lark Buntings, and Brewer's Sparrows were most frequent in areas with greater plant cover. An updated checklist of birds for the Pawnee Site is included.

TR029 Baldwin, P. H., J. D. Butterfield, P. D. Creighton, and R. Shook. 1969. Summer ecology of the Lark Bunting, Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 29. Colorado State Univ., Fort Collins. 37 p.

Lark Bunting, Nesting, Feeding habit, Predation, Birds, Pawnee

Through investigation of the characteristics of the vegetation at the nest site, some of the characteristics of nest site selection have been shown for the Lark Bunting for the shortgrass plains. In this environment, a protective plant is found by each nest. Saltbrush is "used" more often in this plant and nest association than any other plant. It is associated nearly as much as all the rest of the plants together, apparently because of greater protective value afforded by its generally dense foliage and the resulting shade and concealment. Browse type vegetation is associated with the nest in a protective role more often than grass and the annual forb types. The birds' nests are associated most often with plants from 6 to 11 inches in height.

The placement of nests on the lee side of the protective plant reduces impact of the physical environment.

Nest densities were highest in the Class III areas (bush and grass). The Class III areas were followed by Class II (shortgrass), and finally by Class I areas (generally taller vegetation). The nest densities were 0.125, 0.10, and 0.06 birds per acre.

The young spend less time (eight to nine days) on the nest than do comparable bush- and tree-nesting passerines (10 to 19 days). This is indicative of the relative insecurity of nests on the ground, as compared with nests located above the ground.

Shading of the nest by an associated plant allows the highly visible, darkly-colored male to participate to considerable extent in the nesting activities. The male was found to share incubation and brooding with the female.

The total number of eggs laid by Lark Buntings in 43 nests was 154. Of these 96 hatched, 39 were taken by predators, and 15 eggs did not hatch. Fifty animal food items were recovered from nestlings, grasshoppers constituting 84% of the prey fed to young. Adult Lark Buntings ate 12.9 insects per meal, and plant food, consisting mainly of seeds and grains, averaged 36% of the diet.

TR030 Franklin, W. T. 1969. Mineralogy of representative soils at the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 30. Colorado State Univ., Fort Collins. 10 p.

Pawnee, Soil physical characteristics, Soil chemical characteristics

This report gives the results of particle size fractionations of soil samples collected from four soil series, Ascalon, Vona, Renohill, and Shingle, at the Pawnee Site. To a large extent the differences in the soil series relate to differences in the geologic parent materials. Considerable evidence of alluvial or colluvial activity as indicated by stratification was observed on the Renohill and Shingle soils.

TR031 Moir, W. H., J. P. Boratgis, R. Sherman, and G. Paetsch. 1969. Photosynthesis of shortgrasses under field conditions. U.S. IBP Grassland Biome Tech. Rep. No. 31. Colorado State Univ., Fort Collins. 17 p.

Photosynthesis, Shortgrass, Carbon dioxide exchange, Soil respiration, Blue grama, Buffalo grass, Respiration

Progress to September 1969 consisted mainly in developing and improving an instrumentation system for measuring carbon dioxide gas exchange in plants growing under field conditions. The observation system now includes a rigorous gas flow and temperature control.

By August 1969 major components of the photosynthesis measurement system had been tested and found satisfactory, although further improvements and modifications of some subsystem components are envisioned. The response of shortgrasses to diurnal ambient changes was measured during two weekends near the end of the growing season. Additional responses in gas exchange were measured during short periods of the active growing season, and the results are discussed.

Plans for the 1970 season include replication of photosynthesis measurements at up to six field sites, continuous diurnal observations correlated with major phenological events, measurements of soil respiration under field conditions, and measurements of the influence of plant moisture stress to carbon dioxide exchange rates.

TR032 Swartzman, G. [Coordinator]. 1970. Some concepts of modelling. U.S. IBP Grassland Biome Tech. Rep. No. 32. Colorado State Univ., Fort Collins. 142 p.

Modelling concept, Models, Producer model, Consumer model, Decomposer model, Abiotic model

This technical report, developed through a team approach, gives a summary of the modelling concepts used in the U.S. IBP Grassland Biome. After a brief introduction to the history of the project, the kinds of modelling techniques or approaches are presented including compartment models, transfer functions, population dynamics, electrical analog energetics, structural models, and statistical models. Following this is an introduction to the hierarchical concept and formulation of hierarchical diagrams to represent causal relationships of processes for producers, consumers, detritus chain, climatic, and edaphic variables. The discussion also involves the development of models from these diagrams and the categorization of existing models within the hierarchical framework. After a section on the interrelationships between models and generalized notation conventions for our modelling, a theoretical framework is introduced for the evaluation of experiments in view of their inputs into a model and vice versa. A simplified example of this approach is presented. Finally, our ideas about a series of models applied to areas of varying dimension (e.g., one grassland experiment station, all temperate grasslands, all grasslands, etc.) are given.

TR033 Uresk, D. and P. L. Sims. 1969. Preliminary methodology and results for aboveground herbage biomass sampling on the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 33. Colorado State Univ., Fort Collins. 13 p.

Pawnee, Aboveground plant biomass, Blue grama, Litter, Standing dead, Grazing influence

Biweekly sampling of herbage biomass including (1) standing vegetation of all species, (2) standing live and dead of blue grama (*Bouteloua gracilis*), and (3) litter was conducted during the summer 1969. Phenology data was taken on the primary species at each sampling date. The procedures of data collection and data summaries are presented.

TR034 Swift, D. M. [Coordinator]. 1970. Current generalized computer programs used in Grassland Biome analyses. U.S. IBP Grassland Biome Tech. Rep. No. 34. Colorado State Univ., Fort Collins. 286 p.

Computer programs

This report deals with the functioning programs which are available at the Natural Resource Ecology Laboratory at CSU and have been useful in the IBP Grassland Biome activities. These include generalized statistical programs as well as generalized mathematical programs such as routines for solving differential equations.

All programs are described in general terms so that investigators not familiar with programming may evaluate their utility to various types of data. Those programs which are most frequently used or which are deemed most useful to the field investigator or the modeler are discussed in some detail. The reader will note that most of the programs can be set up and run very simply by merely adding a few control cards and a data deck to the source deck. Others, however, require a user-supplied subroutine, which presupposes that the potential user have a knowledge of FORTRAN programming. FORTRAN listings are included for these programs unless such listings are readily obtainable from some other source. Programs less frequently used or of less general interest are discussed briefly in Appendix 1.

TR035 French, N. R. 1970. Field data collection procedures for the Comprehensive Network 1970 season (Revised). U.S. IBP Grassland Biome Tech. Rep. No. 35. Colorado State Univ., Fort Collins. 37 p.

Field data procedures

This report describes a variety of procedures to be used for field data collection from the abiotic, producer, consumer, and decomposer components of the grassland ecosystem on the Comprehensive Network Sites for the 1970 sampling season.

TR036 Rickard, W. H. and T. P. O'Farrell. 1970. Comprehensive Network Site description, ALE. U.S. IBP Grassland Biome Tech. Rep. No. 36. Colorado State Univ., Fort Collins. 5 p.

Site description, ALE

The Arid Land Ecology project is located in southeastern Washington and occupies approximately 120 sq miles of completely fenced land area. The vegetation is typical of xeric bunchgrass. The climate is characterized by a hot, dry summer and a cool, moist winter.

TR037 Morris, M. S. 1970. Comprehensive Network Site description, BISON. U.S. IBP Grassland Biome Tech. Rep. No. 37. Colorado State Univ., Fort Collins. 23 p.

Site description, Bison site, Plant checklist, Bird checklist, Soil water, Soil types, Climate

The National Bison Range in Montana comprises an 18,500-acre fenced area bounded approximately by the Jocko River on the south and Mission Creek on the north. The grassland vegetation represents a transition between the Palouse Prairie and the Fescue Grassland. Climate, soil, animals, and some vegetation data from earlier studies are described.

TR038 Collins, D. 1970. Comprehensive Network Site description, BRIDGER. U.S. IBP Grassland Biome Tech. Rep. No. 38. Colorado State Univ., Fort Collins. 10 p.

Site description, Bridger, Plant checklist, Bird checklist, Insect checklist, Soil physical characteristics, Soil chemical characteristics, Climate

This site is located in southwestern Montana about 14 air miles northeast of Bozeman, the actual research area being approximately 35 acres. The vegetation is mountain bunchgrass-forb type. Descriptions of climate and soil, and checklists of plants, birds, and orthoptera are included in the report.

TR039 Lewis, J. K. 1970. Comprehensive Network Site description, COTTONWOOD. U.S. IBP Grassland Biome Tech. Rep. No. 39. Colorado State Univ., Fort Collins. 26 p.

Site description, Cottonwood, Stocking rate, Plant checklist, Amphibian checklist, Reptile checklist, Bird checklist, Mammal checklist, Climate, Insect checklist

The Cottonwood Site, owned and controlled by South Dakota Agricultural Experiment Station, having an area of 2,640 acres, is located in west-central South Dakota. The station lies in the central portion of the mixed prairie. Climate and soil are described. Checklists of plants, herpetofauna, mammals, and birds are provided.

TR040 Whitman, W. C. 1970. Comprehensive Network Site description, DICKINSON. U.S. IBP Grassland Biome Tech. Rep. No. 40. Colorado State Univ., Fort Collins. 15 p.

Site description, Dickinson, Plant checklist, Climate

The Dickinson Site is located on the Flasher loamy fine sand near the city of Dickinson in the southwestern part of North Dakota, at 46° 53' N latitude and 102° 49' W longitude. The specific study area consists of a 4-acre enclosure within a 27-acre tract of native grass which is fairly typical of northern Great Plains mixed grass prairie. The climate of the area is semiarid with moderately cold winters and warm, dry, sunny summers, precipitation averaging 15.65 inches. A checklist of plants occurring in the area is provided.

TR041 Tomanek, G. W. 1970. Comprehensive Network Site description, HAYS. U.S. IBP Grassland Biome Tech. Rep. No. 41. Colorado State Univ., Fort Collins. 6 p.

Site description, Hays

The study areas at Hays are located approximately 2 miles southwest of the city of Hays in west-central Kansas. The site consists of an ungrazed and a grazed stand of mixed prairie vegetation. Important species of plants, rodents, larger mammals, and birds are enumerated. The climate and soil are briefly described.

TR042 Heady, H. F. 1970. Comprehensive Network Site description, HOPLAND. U.S. IBP Grassland Biome Tech. Rep. No. 42. Colorado State Univ., Fort Collins. 11 p.

Site description, Hopland, Climate

The Hopland Site is located on the Hopland Field Station, some 3 miles east of Hopland, California, comprising approximately 4,750 acres. The vegetation is termed California Annual Grassland. Features of climate and soil are briefly described.

TR043 Herbel, C. H. and R. D. Pieper. 1970. Comprehensive Network Site description, JORNADA. U.S. IBP Grassland Biome Tech. Rep. No. 43, Colorado State Univ., Fort Collins. 21 p.

Site description, Jornada, Plant checklist, Mammal checklist, Bird checklist, Insect checklist, Climate

The Jornada Site is located on the Jornada Experimental Range which consists of 190,700 acres near Las Cruces, New Mexico. Major grassland types are black grama and tobosa types while shrub types are represented by various combinations of mesquite, tarbush, and creosote bush. The site experiences a hot summer and a cool winter with 27.76 cm average annual rainfall. Common plants, small mammals, birds, and insects are listed.

TR044 Risser, P. G. 1970. Comprehensive Network Site description, OSAGE. U.S. IBP Grassland Biome Tech. Rep. No. 44. Colorado State Univ., Fort Collins. 5 p.

Site description, Osage, Plant checklist, Mammal checklist, Insect checklist

The Osage Site is located on the Adams Ranch in the northeast corner of Oklahoma, about 12 miles north and 5 miles east of Shidler. The average temperature ranges from 36.9°F (January) to 81.8°F (July), and the average annual precipitation is 36.6 inches. The soil is a Brunizem of the Labette-Summit-Sogan association, and the grassland is tallgrass prairie type. Common plants, mammals, and insects are enumerated.

TR045 Huddleston, E. W. 1970. Comprehensive Network Site description, PANTEX. U.S. IBP Grassland Biome Tech. Rep. No. 45. Colorado State Univ., Fort Collins. 12 p.

Site description, Pantex, Plant checklist, Evaporation, Climate

The study site at Pantex is located on the Texas Tech University Research Farm in the northeastern Panhandle of Texas, 15 miles east of Amarillo, Texas. The ungrazed study area is located in a 35-acre pasture, and the grazed area in a 158-acre pasture. The grassland is characterized as shortgrass prairie with blue grama predominating. Climate and soil are briefly described.

TR046 Bledsoe, L. J. 1970. ODE: Numerical analysis for ordinary differential equations. U.S. IBP Grassland Biome Tech. Rep. No. 46. Colorado State Univ., Fort Collins. 42 p.

Differential equation, Computer programs

ODE (ordinary differential equation) is a general purpose routine for solving sets of ordinary differential equations. The output of ODE consists of a list of the values for the dependent variables at various time points specified by the input data cards. ODE can be used to simulate any situation where a physical or biological mechanism has been described by a set of ordinary differential equations. A four-compartment linear constant coefficient compartment model is exemplified.

TR047 Nunn, J. R., L. J. Bledsoe, and R. D. Burman. 1970. Models for inferring evaporation from meteorological measurements. U.S. IBP Grassland Biome Tech. Rep. No. 47. Colorado State Univ., Fort Collins. 20 p.

Models, Evaporation, Evaporation model

This is an attempt to summarize most of the available methods for prediction of evapotranspiration flux, with discussion of their applicability. Included are mass transport methods, aerodynamic methods, Eddy correlation, energy balance and Bowen's ratio, and empirical methods.

TR048 Huddleston, E. W., C. R. Ward, R. E. Howard, and L. G. Richardson. 1969. Some contributions to the study of grasslands insect populations. U.S. IBP Grassland Biome Tech. Rep. No. 48. Colorado State Univ., Fort Collins. 9 p.

Pantex, Insect population, Insects

The report embodies investigations to evaluate three methods of sampling of insect populations, viz., quick-trap, D-vac vacuum insect net, and the sweep net. The results indicated a very poor correlation between the numbers of insects in each taxa counted and the sampling method employed. The sweep net method appeared to grossly underestimate numbers of every taxa while the D-vac data indicated that this method overestimates the population in some groups and underestimates other groups when compared to the quick-trap method. The latter method appears to be the most efficient one.

TR049 Herrmann, S. J., J. W. LaVelle, and J. A. Seilheimer. 1970. Aquatic primary productivity and physical-chemical limnology on the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 49. Colorado State Univ., Fort Collins. 19 p.

Pawnee, Ponds, Phytoplankton, Phytoplankton productivity, Pond physical characteristics, Pond chemical characteristics

Monthly measurements of community primary productivity, planktonic primary productivity, and physical-chemical parameters have begun on the Pawnee Site. Preliminary data are reported and trends are beginning to appear, particularly in reference to physical-chemical changes of a seasonal nature.

TR050 Thatcher, T. O., G. Inyamah, and J. E. Mitchell. 1970. Sampling insect populations by sweep net on the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 50. Colorado State Univ., Fort Collins. 10 p.

Pawnee, Insects, Insect population

Insect samples collected by sweep net on the Pawnee Site were influenced by weather at the time of sampling as well as by population changes. Consideration of these effects allows a better understanding of insect behavior and reduces the sampling required.

TR051 Hansen, R. M. and B. R. Cavender. 1970. Assimilation rates of small mammal herbivores. U.S. IBP Grassland Biome Tech. Rep. No. 51. Colorado State Univ., Fort Collins. 7 p.

Mammals, Ingestion, Metabolic rate, Mammal metabolism, Rodent, Lagomorph, Mammal assimilation

This Technical Report was prepared to make it possible for the programmers in the Grasslands Biome to calculate the probable energy demands made by a population of small mammals on the grassland ecosystem.

TR052 Clark, F. E. 1970. The microbial component of the ecosystem. U.S. IBP Grassland Biome Tech. Rep. No. 52. Colorado State Univ., Fort Collins. 14 p.

Energy flow, Nematodes, Microflora, Microbial energy flow

The soil microflora accounts for one-half of the total dissipation of the net primary productivity. Excepting the dominant primary producers, these organisms are not only the major component of the total biomass, but they also constitute the major pathway of dissipation of energy stored annually by photosynthesis. The calculated microbial energy flow assumes an improbable order of magnitude, from several hundred thousand to a million or more kcal/m^2/year. A measurement of microbial activity seems to be more desirable than just a measure of population or biomass. Pertinent literature on available methods and some results are reviewed.

TR053 Cwik, M. J. 1970. Identification of insects and density determinations of the stomach contents of small mammals. U.S. IBP Grassland Biome Tech. Rep. No. 53. Colorado State Univ., Fort Collins. 10 p.

Pawnee, Insect fragment identification, Mammals, Food composition

This report presents a microanalytical method for (1) insect identification in small mammal stomachs and (2) visual estimates of the stomach contents in terms of the relative densities of the insects positively identified, and the total plant:animal ratio. Identification of insects by their fragments was verified by T. O. Thatcher, CSU Entomologist; P. H. Baldwin, CSU Ornithologist; and use of reference vials of specific insect fragments. Stomachs used were of the thirteen-lined ground squirrel (*Spermophilus tridecemlineatus arenicola* Howell), Ord's kangaroo rat (*Dipodomys ordii luteolus* Goldman), northern grasshopper mouse (*Onychomys leucogaster arcticeps* Rhoads), prairie deer mouse (*Peromyscus maniculatus osgoodi* Mearns). These animals were trapped at the Pawnee National Grasslands and surrounding areas, located in northeast Colorado.

TR054 Wolff, D. N. 1970. Grassland infiltration phenomena. U.S. IBP Grassland Biome Tech. Rep. No. 54. Colorado State Univ., Fort Collins. 125 p.

Infiltration, Infiltration rate

The infiltration of precipitation into grassland sites, especially rangelands, is a critical factor in maintaining vigor of the plant cover. Infiltration rates on grassland sites are affected by numerous interacting phenomena of the soil, atmospheric, and vegetational systems. A review of infiltration literature including the processes involved, factors affecting it, and methods of measurement is presented. Infiltration data collected on a wide variety of grassland sites is summarized by geographic region, range condition, and soil index and is represented in tabular form.

On the typical grassland areas range condition exhibits a greater control over infiltration values than does soil influences. However, the reverse situation occurs in semiarid regions where vegetation is characteristically sparse. The average (P = 0.5) one hour duration storm is capable of being infiltrated on practically all range sites studied. Good and excellent condition ranges can generally accomodate the average (P = 0.5) ten minute duration storm without producing too much runoff.

TR055 Streeter, C. L. 1970. Standardized processing and storage scheme for samples collected for IBP Grassland Ecology Research Laboratory. U.S. IBP Grassland Biome Tech. Rep. No. 55. Colorado State Univ., Fort Collins. 5 p.

Sample processing, Sample storage

This technical report describes (i) a standardized processing and storage scheme and (ii) the analysis request sheet. The former is to be used by the investigators requesting analysis to determine processing required prior to sending samples to the laboratory, and the latter is used to indicate the required analysis.

TR056 Hendricks, B. J. 1970. Style and format of technical reports. U.S. IBP Grassland Biome Tech. Rep. No. 56. Colorado State Univ., Fort Collins. 42 p.

Style technical report

This technical report covers the style and format desired for IBP technical reports. All technical reports submitted to the IBP Grassland Biome project should be in this form before being submitted for final typing. This will help provide cleaner copies and faster service.

TR057 Van Dyne, G. M. 1970. Some observations on foreign grassland and related research: April - July 1970 Van Dyne trip report. U.S. IBP Grassland Biome Tech. Rep. No. 57. Colorado State Univ., Fort Collins. 25 p.

Trip report

TR058 Bell, R. T. 1970. Identifying Tenebrionidae (darkling beetles). U.S. IBP Grassland Biome Tech. Rep. No. 58. Colorado State Univ., Fort Collins. 12 p.

Darkling beetle, Pawnee, Insects, Insect systematics, Beetle, Beetle systematics

This report contains keys and descriptions of Tenebrionidae (darkling beetles) known to occur on the Pawnee Site. It is designed to be used in conjunction with a synoptic set in the reference collection at the site headquarters and is intended for the use of workers who are not trained taxonomists. Technical terminology is kept to a minimum. The arrangement of species in the keys is not phylogenetic, but is based on the most easily observed reliable characteristics. The descriptions are arranged in alphabetic order and emphasize comparisons with the species which are most likely to be confused with the one under consideration. Twenty-three species are recorded from the site. Complete identification has had to be deferred in *Blapstinus* and three less important genera.

TR059 Wright, R. G. and F. M. Smith. 1970. Grassland Biome graduate student symposium--A review. U.S. IBP Grassland Biome Tech. Rep. No. 59. Colorado State Univ., Fort Collins. 40 p.

Symposia report

This paper reports on the organization and results of a two-day meeting involving 83 graduate students and technicians from the intensive and comprehensive sites of the Grassland Biome Program, US IBP. The considerations and hang-ups of small group (interest area) discussions are included along with a summary of the individual critiques and evaluations submitted by the participants.

TR060 Welch, W. R. 1970. A numerical analysis of grassland faunal resemblances. U.S. IBP Grassland Biome Tech. Rep. No. 60. Colorado State Univ., Fort Collins. 22 p.

Intersite comparison, Mammals

Species lists of small mammals at eight grassland sites were compiled. Coefficients of Community among the sites were computed and subjected to cluster analysis. The resulting relationships are discussed and suggestions are made for additional and expanded study.

TR061 Clark, F. E. 1970. Decomposition of organic materials in grassland soil. U.S. IBP Grassland Biome Tech. Rep. No. 61. Colorado State Univ., Fort Collins. 23 p.

Decomposition, Decomposition cellulose, Decomposition plant, Decomposition soil organic matter

Burial and retrieval of cellulose filter paper or of herbage materials, in conjunction with gravimetry and ignition, has been found an operationally simple procedure for studying microbial responses to the field environment. It has been observed that decomposition at the Pawnee Grassland site occurs during bursts of microbial activity elicited by favorable conditions of moisture and temperature. During the growing season, decomposition of organic material occurred in a stepwise pattern, with intense activity following seasonal precipitation and plateaus of zero or negligible activity during seasonal droughts. No soil decomposer activity was observed during the winter months.

Data were also accumulated concerning both the susceptibility of the herbage of different plant species to decomposition and the changes in susceptibility within a given species during the course of the growing season. Grasses were distinctly more resistant to decomposition than were annual forbs. For individual species of either grasses or forbs, early season herbage collections were more susceptible to decomposition than were late season collections. Some good correlations have been observed concerning the fate of herbage materials in soil microbial systems in comparison with their fate in herbivore microbial systems.

TR062 Giezentanner, J. B. 1970. Avian distribution and population fluctuations on the shortgrass prairie of north central Colorado. U.S. IBP Grassland Biome Tech. Rep. No. 62. Colorado State Univ., Fort Collins. 113 p.

Birds, Bird distribution, Bird biomass, Bird population, Bird checklist, Brewer's Sparrow, Horned Lark, Lark Bunting, Meadowlark, McCown's Longspur

Birds of the shortgrass prairie of north central Colorado were studied during 1969-70 to determine species, numbers, standing crop biomass, and population fluctuations on the Central Plains Experimental Range. Two systems of counts were used: a roadside count, and a census of six, 20-acre plots, which were used to determine the effects of grazing by cattle on the distribution of birds. Total populations, breeding-pair populations, standing crop biomass, and bird-use days were determined for two breeding seasons, a post-breeding season, and winter. The breeding population (65.5 and 48.4 pairs/100 acres in 1969 and 1970, respectively) was composed of eight species of which five provided 95% of all nesting. Horned Larks and Lark Buntings were the most abundant nesters. Horned Larks and McCown's Longspurs were the primary post-breeding species. Horned Larks and Lapland Longspurs were the primary winter species. Plots heavily grazed by cattle received the greatest use by birds for nesting and foraging; lightly-grazed plots received the least use. The composition of populations using each plot varied considerably in numbers and species. Conclusions about the avifauna of the prairie are offered.

TR063 Wiens, J. A. 1970. Avian populations and patterns of habitat occupancy at the Pawnee Site, 1968-1969. U.S. IBP Grassland Biome Tech. Rep. No. 63. Colorado State Univ., Fort Collins. 47 p.

Pawnee, Birds, Grazing influence, Territoriality, Bird population, Bird diversity, Bird density, Spatial overlap, Horned Lark, Meadowlark, Lark Bunting, Brewer's Sparrow, McCown's Longspur

This report analyzes the ecological relations of breeding birds on two 10.6 ha plots subjected to different grazing regimes at the Pawnee Site. Emphasis is given the relation of various population parameters (species diversity, density, interspecific spatial overlap, biomass) to vegetational heterogeneity, and the position of the Pawnee results in relation to a spectrum of grassland-shrubsteppe samples from other areas. In addition, characteristics of vegetation structure in areas occupied and not occupied by each of the breeding species are analyzed and are discussed in the context of interspecific differences, year-to-year changes, and responses to grazing treatment.

TR064 Bledsoe, L. J., R. C. Francis, G. L. Swartzman, and J. D. Gustafson. 1971. PWNEE: A grassland ecosystem model. U.S. IBP Grassland Biome Tech. Rep. No. 64. Colorado State Univ., Fort Collins. 179 p.

Pawnee, Pawnee model, Ecosystem model, Models

The primary objective of Grassland Biome Project modelling efforts this year (1970) has been to produce a mechanistic total system model of a grassland ecosystem. The result has been a model which is mechanistic to the extent that, wherever possible, the mathematical formulations are analogous, at some level of resolution, to the functional mechanisms operating within the system.

The model is primarily designed to describe the shortgrass prairie ecosystem of the Pawnee National Grassland. It is designed as a highly modular system for two reasons:

i. So that individual processes or mechanisms may be changed as information becomes increasingly available, and

ii. So that the model can be used in situations having greater (Pawnee Site) or lesser (Comprehensive Sites) detail in data and information.

The current version of the model is in a first-pass condition, and has not been subjected to extensive scientific debugging (i.e., the mechanisms have not been closely reexamined by biologists).

The model is structured in the following way:

i. It is a time-dependent biomass model. No spatial aspects are taken into consideration at present.

ii. The primary equations to be solved make up a series of first-order differential equations. Thus, the equations for the principal system variables express the rate of change of biomass with respect to time.

iii. The total model is made up of trophic level submodels. Within each trophic level various functional relations describe the processes.

A set of 40 first-order differential equations has been developed to describe the abiotic, producer, consumer, and decomposer components of the ecosystem. The abiotic section involves driving forces of solar energy, air temperature, wind speed and precipitation, and driven variables of microclimatic temperature, soil temperature, and soil moisture. The producer variables consist of biomass density of aboveground live biomass for four plant functional groups, plant standing dead, plant litter, and plant live roots. The consumer biomass is compartmentalized as animal live material, animal dead material, and animal fecal material. The animal live biomass is further subdivided into five functional groups (wild primary consumers-mammal, domestic primary consumers-mammal, secondary consumers-mammal, birds, and insects). The decomposer compartments are mediated by microbial functional groups whose activity is in turn controlled by their biotic and abiotic environment.

TR065 Alldredge, A. W. and F. W. Whicker. 1971. Soil movement in a grassland ecosystem as measured by beta particle attenuation. U.S. IBP Grassland Biome Tech. Rep. No. 65. Colorado State Univ., Fort Collins. 21 p.

Erosion, Soil movement

This report covers progress made on a soil movement study being conducted at the Pawnee Site. A method involving beta attenuation was developed and employed. From initial investigation, this method gives sensitive measurements of both erosion and deposition of soil and litter over a period of a few weeks. Data recorded on 265 field plots are summarized in tables. Future plans include continuing observation of field plots and laboratory studies to solve minor problems with the beta attenuation method as well as those associated with a proposed cesium tag concept.

TR066 Bell, R. T. 1971. Carabidae (ground beetles). U.S. IBP Grassland Biome Tech. Rep. No. 66. Colorado State Univ., Fort Collins. 58 p.

Insects, Pawnee, Ground beetle, Insect systematics, Beetle, Beetle systematics

This report contains keys and descriptions of the Carabidae (ground beetles) known to occur on the Pawnee Site. The tiger beetles are included as subfamily Cicindelinae. The paper is designed to be used in conjunction with a synoptic set in the site reference collection and is intended for the use of workers who are not trained taxonomists. Technical terminology is kept at a minimum. The family is divided into tribes. The dominant tribe, Harpalini, is discussed first, and the remaining ones follow in alphabetical order. Within the tribes, the arrangement in the key is not phylogenetic, but is based on the most easily observed reliable characteristics. The descriptions are arranged in alphabetic order and emphasize comparisons with the species most likely to be confused with the one under consideration. There are 81 species in the family recorded from the Pawnee Site.

TR067 Creighton, P. D. 1971. Progress report, work on bird feeding and nesting behavior at the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 67. Colorado State Univ., Fort Collins. 40 p.

Pawnee, Birds, Feeding habit, Nesting, Bird growth, Food composition, Lark Bunting, McCown's Longspur, Horned Lark, Bird distribution

The research scope during the summer of 1970 was changed from a specific study of the Lark Bunting (*Calamospiza melanocorys*) to a multispecies approach involving, in addition, McCown's Longspurs (*Rhynchophanes mccowni*).

chestnut-collared Longspurs (*Calcarius ornatus*) and Horned Larks (*Eremophila alpestris*). The inter-relationships of these species were investigated in the field along two lines: (a) are there temporal segregations of breeding cycles, and (b) is there a spatial distribution of these songbirds?

Laboratory studies were initiated with young of each of the four species to determine daily growth rates, amount of foods consumed, and selection of food sizes.

TR068 Creighton, P. D. 1971. Nesting of the Lark Bunting in north-central Colorado. U.S. IBP Grassland Biome Tech. Rep. No. 68. Colorado State Univ., Fort Collins. 17 p.

Lark bunting, Birds, Nesting, Food composition, Bird growth

Despite its local abundance on the short-grass prairies of the plains states, there is relatively little information recorded of the nesting ecology of the Lark Bunting, *Calamospiza melanocorys*. Bailey and Niedrach (1965) did present a general description of this species in Colorado, and secondary information on the Lark Bunting is best summarized by Baumgarten (1968); but even this contribution draws on preliminary, fragmentary, and often conflicting data, i.e., Cameron (1908), Langdon (1933) and Roberts (1936). Current field study information is presented here to clarify and to enlarge upon various aspects of nesting Lark Buntings, such as parental roles of sexes, nestling foods, and growth rates of young.

TR069 Green, J. L. and C. V. Cole. 1971. Growth of *Bouteloua gracilis* in a biosynthesis chamber. U.S. IBP Grassland Biome Tech. Rep. No. 69. Colorado State Univ., Fort Collins. 33 p.

Photosynthesis, Net photosynthesis, Plant respiration, Soil respiration, Blue grama, Carbon dioxide exchange, Respiration

Blue grama grass sods, 10 cm in depth, having a total surface area of 0.62 m^2 were grown in a closed system to which $^{14}CO_2$ of 0.3 μCi/mmole specific activity was added. Uniformly labeled top regrowth was collected in three successive harvests. Measurements of soil and plant respiration and net CO_2 assimilation (photosynthesis) were made. Proposed use of the material produced within the biosynthesis chamber environment in a study to estimate field decomposition rates is discussed.

TR070 Hansen, R. M. [Coordinator]. 1971. Drawings of tissues of plants found in herbivore diets and in the litter of grasslands. U.S. IBP Grassland Biome Tech. Rep. No. 70. Colorado State Univ., Fort Collins. 69 p.

Plant fragment identification

This report supersedes Technical Report No. 18 and describes in greater detail the microscope technique used in the identification of plant fragments. This report explains how percentage density is converted to relative percentage density. It shows how to estimate the percentage dry weight of each species of plant in herbivore diets, litter, mulch, and other complex plant species mixtures using the microscope technique. The complete report also consists of drawings of plant fragments commonly found in the samples that have been processed in the Grasslands Ecology Research Laboratory.

TR071 Herrmann, S. J. 1971. Physical and chemical limnology of Cottonwood Pond and Spring Pond (Sept. 1969--Dec. 1970). U.S. IBP Grassland Biome Tech. Rep. No. 71. Colorado State Univ., Fort Collins. 27 p.

Ponds, Pond physical characteristics, Pond chemical characteristics

For the period September 1969 to December 1970, the following physical and chemical parameters were studied monthly in Cottonwood Pond and Spring Pond on the Pawnee Site: temperature, dissolved oxygen, hydrogen ion concentration, turbidity, total residue, conductance, hardness (total Ca, Mg), sodium, potassium, alkalinity (P and T), chloride, and sulfate. Several other variables were studied on an irregular basis: iron, phosphate, nitrate, and ammonia. In addition, a complete morphometric consideration of each pond was made.

TR072 Knight, D. H. 1971. Some measurements of vegetation structure on the Pawnee Grassland, 1970. U.S. IBP Grassland Biome Tech. Rep. No. 72. Colorado State Univ., Fort Collins. 43 p.

Vegetation structure, Leaf area index, Cover, Grazing influence, Blue grama, Phenology, Interception, Plant cover

This report contains the results of measurements on the vegetation structure of the Pawnee Grassland in 1970. The measurements were made primarily at microwatersheds 2, 3, 5, and 7--one each in management units subject to heavy, moderate, light, and zero grazing pressure by cattle. Estimates are presented for total green leaf area index (LAI), total green and brown LAI, *Bouteloua gracilis* green LAI, and *Bouteloua* brown LAI. Also summarized in this report are data on percent cover by the succulent, bunch grass, and shrub growth forms; percent bare ground; percent vegetation cover from various solar angles; percent mulch cover; and average vegetation height. These measurements will be used for ecosystem simulation, for intra- and interbiome comparisons, and for evaluating the magnitude of energy and water flux modification by vegetation structure.

TR073 Nunn, J. R. [Coordinator]. 1971. Meteorological data acquisition system, September 1, 1970 - December 31, 1970. U.S. IBP Grassland Biome Tech. Rep. No. 73. Colorado State Univ., Fort Collins. 28 p.

Meteorology, Air temperature, Soil temperature, Atmospheric water, Solar radiation, Net radiation, Lysimeter, Pawnee

The primary effort in the meteorological portion of the IBP for this interim period was to evaluate the potential of the 36-channel data acquisition system. This evaluation was done through continuous operation of the system, analysis of typical data, and establishment of calibration procedures. The data acquisition system collected meteorological information from two contrasing plots separated 1,000 ft apart. Air and soil temperature, radiation, wind speed, wind direction, and humidity parameters were monitored by the recording system. Final plans were approved, and construction is nearing completion for a relatively undisturbed 3-m diameter lysimeter.

TR074 Smith, F. M. 1971. Growing season precipitation records, Central Plains Experimental Range A.R.S., Nunn, Colorado. U.S. IBP Grassland Biome Tech. Rep. No. 74. Colorado State Univ., Fort Collins. 73 p.

Pawnee, Precipitation, Growing season

Precipitation measurements for the growing season (ca. April through October) have been collected on the Central Plains Experimental Range (CPER) since 1940 and are continuing. In an area of about 36 km^2, data has been collected from 29 rain gages. Twenty-one gages have complete records to the present.

TR075 Striffler, W. D. 1971. Hydrologic data, 1970, Pawnee Grasslands. U.S. IBP Grassland Biome Tech. Rep. No. 75. Colorado State Univ., Fort Collins. 23 p.

Pawnee, Hydrology, Barometric pressure, Precipitation, Runoff, Watershed

This report presents the data collected during the 1970 calendar year as part of the hydrologic process studies of the Grassland Biome Intensive Site Studies, IBP. Data presented are from the field recording instrumentation and daily observations and include precipitation, runoff from the microwatersheds, and observations from an evaporation station.

In general, the 1970 year was drier than normal with an annual total of 245 mm as compared to the 30-year mean annual rainfall of 310 mm. The greatest deficit occurred during the summer months from May through August. Precipitation during March and April was above normal, which helped to recharge soil water storage and offset the lack of rainfall later in the growing season.

Three runoff events occurred during the year. However, only one was of sufficient magnitude to produce runoff from all the microwatersheds and permit a comparison between treatments.

TR076 Van Haveren, B. P. 1971. Measurement of the energy status of water in a grassland ecosystem. U.S. IBP Grassland Biome Tech. Rep. No. 76. Colorado State Univ., Fort Collins. 21 p.

Water potential, Pawnee, Energy balance

The concept of the free energy status of water in soil and plant systems is discussed together with the theory, instrumentation, and techniques involved in the measurement of water potentials. Preliminary soil water potential data collected on the Pawnee Site are included.

TR077 Wiens, J. A. 1971. Avian ecology and distribution in the Comprehensive Network, 1970. U.S. IBP Grassland Biome Tech. Rep. No. 77. Colorado State Univ., Fort Collins. 49 p.

Birds, Bird distribution, Migration, Bird biomass, Bird population, Grazing influence

This report presents a summarization and preliminary analysis of data obtained on breeding bird populations at six IBP Grassland Biome Comprehensive Network sites and two plots at the Pawnee Site during the spring and summer of 1970. These data were obtained from roadside counts made in the general vicinity of the sites, from 8.4 to 10.6 ha intensive study plots located in grazing treatment areas at each site, and from specimens collected near the study plots. This report considers these data in terms of: (i) species presence and distributions, (ii) population densities, (iii) standing crop biomass, (iv) individual weights, (v) diversity, (vi) ecological structure of the breeding avifaunas, and (vii) general migratory tendencies of the breeding populations.

TR078 Fagan, R. E. and R. D. Pettit. 1971. Herbage dynamics studies at the Pantex Site. U.S. IBP Grassland Biome Tech. Rep. No. 78. Colorado State Univ., Fort Collins. 40 p.

Pantex, Aboveground plant biomass, Belowground plant biomass, Litter, Standing dead

Herbage biomass has been sampled at 2-week intervals for aboveground biomass and at monthly intervals for belowground biomass at the Pantex, U.S. IBP, Site since June 15, 1970. Hand clipping of aboveground biomass with field separation of the major species, blue grama (*Bouteloua gracilis*), plains prickly pear (*Opuntia polyacantha*), little barley (*Hordeum pusillum*) and pepperweed (*Lepidium* spp.), was the sampling technique used. A "Bull" hydraulically operated soil corer was used for root biomass studies.

Twelve aboveground and belowground plots were sampled in each of three treatments--ungrazed, moderately grazed, and grazed 1969/ungrazed 1970. Brushes were used to sweep all plots for litter collection. Root cores were pulverized by hand, then washed, to obtain belowground biomass.

Blue grama and prickly pear made up from 70-90% of the total aboveground biomass. Maximum aboveground biomass--362 g/m^2--was found in the grazed 1969/ungrazed 1970 treatment on July 13. The least biomass, likewise, was found on this treatment on August 24, when only 80 g/m^2 were recorded. At all clipping dates (except one) least biomass was found on the ungrazed site. Higher biomass on the grazed sites was attributed to the increased quantity of prickly pear found on these treatments.

Maximum litter accumulation was found on the ungrazed site, where approximately 30% more was found than on grazed sites. Up to 154 g/m^2 of litter were present on the ungrazed site on June 29; however, only 90 g/m^2 were collected on August 10.

Root biomass estimates indicate more roots to be present in the grazed than ungrazed treatments. A maximum of 952 g/m^2 was found in the grazed 1969/ungrazed 1970 treatment on June 30. Least biomass came from the ungrazed treatment on June 30, when only 399 g/m^2 was found.

Precision of all data collected was very poor. Standard errors in many cases exceeded the means. Modifications of sampling techniques and increased sampling intensity should correct this in 1971.

TR079 Huddleston, E. W., C. R. Ward, C. W. O'Brien, W. J. Fournier, and H. N. Howell, Jr. 1971. Insect population studies. U.S. IBP Grassland Biome Tech. Rep. No. 79. Colorado State Univ., Fort Collins. 41 p.

Insects, Insect population, Pantex, Insect density, Insect biomass, Chewing arthropods, Sucking arthropods

Insect populations on the Pantex Site, U.S. IBP, were quantitatively sampled by "quick trap--D-VAC" combination at two-week intervals from April 10, 1970 to October 23, 1970 inclusive. Qualitative samples were taken by pitfall traps, light traps, sweep net, and observation. Three treatment effects were tested--ungrazed, moderately grazed, and grazed 1969/ungrazed 1970. Each treatment sample consisted of two replications of six randomly selected quadrats. A circular area of 0.5 m^2 was covered by the "quick trap" in each quadrat. Plant litter and insects collected in the "D-VAC" bags were placed in Berlese funnels and left for 48 hours under a 60-watt light bulb. The insects were collected in alcohol. Insects were sorted to easily recognized taxa--family level or below. A bimodal trend in insect numbers was detected during the season. The first maximum occurred in August and was caused by false chinch bug adults and nymphs of these and other Lygaeidae. The maximum number of insects collected per square meter was 5350. Insect biomass was at a maximum in August with 0.20 g/m^2. The percentages of piercing-sucking phytophagous insects tended to exceed the percentages of biting-chewing phytophagous insects in both numbers and biomass. Total insect biomass is expected to exceed 2.0 g/m^2. The lower figures this season were due to imperfection in sampling and extraction of the insects and less than normal rainfall during the season.

TR080 Risser, P. G. 1971. Osage Site, 1970 report, primary production. U.S. IBP Grassland Biome Tech. Rep. No. 80. Colorado State Univ., Fort Collins. 41 p.

Osage, Wind, Precipitation, Solar radiation, Atmospheric water, Air temperature, Soil temperature, Aboveground plant biomass, Belowground plant biomass, Litter, Standing dead, Litter decomposition, Decomposition, Cool grass, Warm grass

Results of the study of primary production on the Osage Site in the 1970 season are summarized in tabular form. These include meteorological data, sampling dates and results of above- and belowground biomass, and litter collection on the grazed and the ungrazed treatment areas.

TR081 Dye, A. J. and W. H. Moir. 1971. CO_2 exchange over shortgrass sods. U.S. IBP Grassland Biome Tech. Rep. No. 81. Colorado State Univ., Fort Collins. 13 p.

Carbon dioxide exchange, Shortgrass, Pawnee, CO_2 ambient, Photosynthesis

Progress to October 1970 consisted mainly of improving the experimental design of an instrumentation system for monitoring carbon dioxide exchange in plants under field conditions. Initial results are presented for both the open flow and compensating systems. Ambient carbon dioxide concentrations are presented as a seasonal decline from a high of 328 ppm CO_2 in April to 322 ppm in September.

TR082 Strong, M. A. and R. A. Ryder. 1971. Avian productivity on the Pawnee Site in north-central Colorado. U.S. IBP Grassland Biome Tech. Rep. No. 82. Colorado State Univ., Fort Collins. 54 p.

Pawnee, Birds, Nesting, Reproduction, Bird growth, Horned Lark, McCown's Longspur, Meadowlark, Lark Bunting, Brewer's Sparrow, Homing range, Bird biomass

Reproductive rates, relative nesting success, and growth rates of nestlings as well as the peaks of nesting activity were determined for Horned Lark (*Eromophila alpestris*), McCown's Longspur (*Rhynchophanes mccowni*), Western Meadowlark (*Sturnella neglecta*), Lark Bunting (*Calamospiza melanocorys*), Loggerhead Shrike (*Lanius ludovicianus*), Mourning Dove (*Zenaidura macroura*), and Brewer's Sparrow (*Spizella breweri*) on and adjacent to the Pawnee Site. Horned Lark and McCown's Longspur nests were mainly in heavily grazed shortgrass, whereas Lark Buntings preferred moderately to slightly grassed areas. Brewer's Sparrows were confined to areas of fourwing saltbush (*Atriplex canescens*). The percent of nests successful in fledging at least one young varied from 26.2% for Horned Lark to 53.6% for Mourning Dove. All ground nesting passerines grew at essentially the same rates. A total of 766 birds representing 31 species were banded and 116 birds of 6 species collected for food habits and reproductive analyses. Homing of 6 and 15 color marked Horned Larks and 1 of 10 color marked Lark Buntings was demonstrated.

TR083 Grant, W. E. 1971. Site comparisons of aboveground plant biomass. U.S. IBP Grassland Biome Tech. Rep. No. 83. Colorado State Univ., Fort Collins. 28 p.

Intersite comparison, Aboveground plant biomass

Intersite comparisons of live aboveground plant biomass were made using data from the 1970 field season. The nine sites compared were the following: Bison, Bridger, Dickinson, Cottonwood, Pawnee, Hays, Osage, Pantex, and Jornada.

TR084 Collins, D. 1971. The Bridger Site, 1970 progress report. U.S. IBP Grassland Biome Tech. Rep. No. 84. Colorado State Univ., Fort Collins. 40 p.

Bridger, Air temperature, Soil temperature, Aboveground plant biomass, Belowground plant biomass, Snow fence, Litter, Standing dead, Cool grass, Cool forb

Field data from investigations of aboveground primary production during the 1970 growing season at the Bridger Site are summarized and tabulated. Included are results from grazed and ungrazed areas, as well as two locations on which snow accumulation was artificially increased. Results from a sample of belowground biomass of plant material are also presented, as well as summary charts of air and soil temperatures through the growing season.

TR085 French, N. R. [Coordinator]. 1971. Basic field data collection procedures for the Grassland Biome 1971 season. U.S. IBP Grassland Biome Tech. Rep. No. 85. Colorado State Univ., Fort Collins. 87 p.

Field data procedures

This report comprises an outline of techniques and methods that will be used in the data collection of the Comprehensive Network during the 1971 collecting season. Participants at the Intensive site (Pawnee) are also attempting to incorporate these procedures as a subset of their own activities. Sample field data sheets are also included to indicate the manner of data collection and the basic format of data in the information storage and retrieval system. This report is an outgrowth of Technical Report No. 35, "Field data collection procedures for the Comprehensive Network 1970 season." Participants met to revise the former report in individual groups during the month of December: Producers, Invertebrates, Small Mammals, and Decomposers. A joint meeting in January with representatives from each group further refined the plans and procedures, and included discussion of abiotic measurements, avian studies, and laboratory analytical procedures. Outlined herein are the collection procedures, preliminary analytical procedures, and data collection procedures for evaluating above- and belowground plant biomass, litter, litter accumulation, invertebrate sampling, small mammal sampling, bird investigations, studies of decomposers, micrometeorological data acquisition, and laboratory analysis requirements.

TR086 Knievel, D. P. and D. A. Schmer. 1971. Preliminary results of growth characteristics of buffalograss, blue grama, and western wheatgrass, and methodology for translocation studies using ^{14}C as a tracer. U.S. IBP Grassland Biome Tech. Rep. No. 86. Colorado State Univ., Fort Collins. 28 p.

Buffalograss, Blue grama, Western wheatgrass, Translocation, Growth analysis, Plant growth, Shoot-root ratio

The temperature response of various growth characteristics of buffalograss (*Buchloe dactyloides* [Nutt.] Engelm), blue grama (*Bouteloua gracilis* [H.K.B.] Lag. ex Steud.), and western wheatgrass (*Agropyron smithii* Rydb.) was determined under controlled conditions. Buffalograss and blue grama had highest growth rates in the 32.2/26.7°C day/night temperature regime, while western wheatgrass grew best in the 15.6/10.0°C and 10.0/4.4°C temperature regimes.

Methodology for studying carbohydrate translocation to belowground parts of buffalograss, blue grama, and western wheatgrass was developed using ^{14}C as a tracer. Methods for administering $^{14}CO_2$ and sampling the plant material, including sample preparation for radioactive analysis, was developed. These procedures and experimental data are discussed.

TR087 Nagy, J. G. and J. P. Hoover. 1971. Pronghorn antelope field food consumption studies. U.S. IBP Grassland Biome Tech. Rep. No. 87. Colorado State Univ., Fort Collins. 63 p.

Pronghorn, Antelope, Food composition, Pawnee, Mammals

This investigation started in December 1969 and will continue during 1971. Methodology was emphasized in the first year of the study. The major objectives are to determine the botanical and chemical composition of the pronghorn diet.

TR088 Nagy, J. G., K. L. Knox, and D. E. Wesley. 1971. Metabolic studies of pronghorn antelope. U.S. IBP Grassland Biome Tech. Rep. No. 88. Colorado State Univ., Fort Collins. 11 p.

Pronghorn, Antelope, Metabolism, Pawnee, Metabolic rate, Digestion, Mammals, Mammal metabolism, Antelope metabolism, Pronghorn metabolism, Mammal metabolic rate

Six young female antelope were trained to accept metabolic chambers which were constructed to permit temperature regulation. Metabolic response of fasting antelope to age followed a pattern similar to that of other ruminants. Metabolic rate dropped rapidly prior to seven months of age and became relatively stable after this age. The mean fasting metabolic rate of mature pronghorn is approximately 70 kcal/kg$^{3/4}$/day. The thermoneutral area for fasting antelope ranged from approximately 32°C to a point just above 0°C. Digestible energy for pronghorn on a mixed concentrate and leafy alfalfa diet was not different from domestic ruminants. Pronghorn, however, metabolized a greater percentage of its digested energy than reported for some domestic ruminants.

TR089 Oliver, R. E. and L. D. Miller. 1971. The design of a spatial data framework central basin watershed, Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 89. Colorado State Univ., Fort Collins. 19 p.

Topography, Watershed, Soil types, Pawnee

This report describes the attributes of a framework and analysis model procedure for spatially distributed data at the Pawnee Site. The needs and possible uses of the procedures along with a description of how some of the data is collected and utilized.

TR090 Pearson, R. L., L. D. Miller, and K. J. Ranson. 1971. A field light quality laboratory--initial experiment: The measurement of percent of functioning vegetation in grassland areas by remote sensing methodology. U.S. IBP Grassland Biome Tech. Rep. No. 90. Colorado State Univ., Fort Collins. 24 p.

Pawnee, Reflectivity, Plant cover, Cover

This technical report contains the progress report from January 1970 to January 1971 and the planning report for January 1971 through January 1972 for the Field Light Quality Laboratory of the Grassland Biome of the International Biological Program. Included in the report are descriptions of lab design as well as the experimentation completed during 1970 which determined how well the lab responds to changes in percent cover of functioning green vetetation and the spectro-reflectances of some common grassland constituents in early October.

TR091 Smith, F. M. 1971. Central Basin hydrologic process studies. U.S. IBP Grassland Biome Tech. Rep. No. 91. Colorado State Univ., Fort Collins. 26 p.

Central basin, Infiltration rate, Grazing influence, Topography, Precipitation, Runoff, Soil water, Hydrology

This report summarizes the objective and approach to the Central Basin Studies and reports the progress to date. In general, the objective of the Central Basin Study is to model the hydrologic behavior of the basin as a complement to the microwatershed studies. For modelling purposes the basin represents a much more complex system than the microwatersheds.

Progress during 1970 includes the preparation of a set of topographic maps of the basin, the tabulation of 30 year rainfall data from the ARS Network, and a field study of infiltration rates of four soil types and three grazing treatments.

TR092 Bledsoe, L. J. and J. D. Gustafson. 1971. Multivariate normal data generator. U.S. IBP Grassland Biome Tech. Rep. No. 92. Colorado State Univ., Fort Collins. 13 p.

Multivariate generator

This FORTRAN program is designed to generate vectors of data whose components are distributed according to the multivariate normal distribution function with a given mean vector and a given covariance matrix. The data generated can be either printed on the output unit or punched on Hollerith cards under program options.

TR093 Blocker, H. D. and R. Reed. 1971. 1970 insect studies at Osage Comprehensive Site. U.S. IBP Grassland Biome Tech. Rep. No. 93. Colorado State Univ., Fort Collins. 38 p.

Osage, Insects, Insect density, Insect biomass, Grazing influence

Results of 1970 collections of insects at the Osage Site are summarized. Samples were collected at approximately two week intervals through the growing season, beginning in July, on the grazed and ungrazed treatment areas.

TR094 Dyck, G. W. and R. E. Bement. 1971. Herbage growth rate, forage intake, and forage quality in 1970 on heavily and lightly grazed blue grama pastures. U.S. IBP Grassland Biome Tech. Rep. No. 94. Colorado State Univ., Fort Collins. 15 p.

Growth rate, Plant growth, Ingestion, Cattle, Mammals, Food consumption, Aboveground plant biomass, Cattle biomass, Mammal biomass, Grazing influence, Cattle production, Pawnee

Herbage growth rate, forage intake, and forage quality were measured on heavily and lightly grazed pastures during the summer of 1970. When a growth opportunity occurred, herbage growth was more rapid on the lightly grazed pasture. Forage intake by individual non-fistulated heifers was greatest on the lightly grazed pasture. Heavily and lightly grazed pastures did not differ significantly in forage quality.

TR095 Boulette, E. P. III, R. C. Porter, and R. W. Gorden. 1971. Microbial biomass measurements at the Pantex Site, 1970. U.S. IBP Grassland Biome Tech. Rep. No. 95. Colorado State Univ., Fort Collins. 16 p.

Pantex, Microbial biomass, Decomposition, Litter decomposition, Bacteria, Bacteria population, Decomposition litter

A study of microbial populations and decomposition of the shortgrass prairie was started in May of 1970 supported by IBP on the Pantex Site. The study was to be conducted in two parts: first, a study of the viable bacterial population over a period of time using the standard plate count technique, and second, a study of microbial decomposition using the litter bag method.

TR096 Donoho, H. S. 1971. Dispersion and dispersal of white-tailed and black-tailed jackrabbits, Pawnee National Grasslands. U.S. IBP Grassland Biome Tech. Rep. No. 96. Colorado State Univ., Fort Collins. 52 p.

Pawnee, Jackrabbit, Dispersion, Jackrabbit distribution, Mammals, Jackrabbit density, Mammal density

Dispersion, dispersal, and density were measured on populations of black-tailed (*Lepus californicus*) and white-tailed (*Lepus townsendii*) jackrabbits on a 10.75 sq mile area of native short-grass prairie. All mammal scientific names used in this report are from *The Mammals of North America* by E. R. Hall and K. R. Kelson (1959). Dispersion information was obtained from a tagging-recapturing program and spotlight counts. Sample size amounted to 136 tagged hares. Black-tails outnumered white-tails 3 to 1 and occupied most of the study area. White-tails occupied a smaller range, mostly overlapping the black-tailed jackrabbit range. Dispersal was measured by a radio telemetry technique which allowed remote monitoring of instrumented hare locations. Individuals of both species exhibited ovate occupation areas (of approximately 640 acres) which did not appear to change in size or location from season to season. Of 28 hares instrumented, six remained active, 14 were lost from radio contact, and eight died from various causes. Density was estimated from counts made on 4.25 sq mile drive plots. The spring (April) and fall (November) counts indicated 33 hares per sq mile and 93 hares per sq mile, respectively. Aerial mapping of hare tracks in snow revealed the greatest hare activity in low shrubby areas with activity gradually diminishing toward higher open grassy areas. Trapping and telemetry failed to show correlation between hare distribution and pastures grazed by cattle at light, moderate, and heavy intensities.

TR097 Nunn, J. R. 1971. 1970 meteorological data availability for the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 97. Colorado State Univ., Fort Collins. 4 p.

Pawnee, Meteorology

A major purpose of the meteorological system of the Grassland Biome, IBP, is to make meteorological data available to other scientists. For some purposes rapid data recording is necessary. Therefore, all values are recorded at one-minute intervals and, normally, summaries are made for one-hour intervals. In order for an investigator to use hourly meteorological data, it is necessary to manually sort through voluminous computer output. Even after considerable time and effort is spent examining the output, it is practically impossible for an investigator to relate data availability of one or several parameters to one or several other parameters. As a result of these difficulties, a summary record of availability was developed.

TR098 Flinders, J. T. and R. M. Hansen. 1971. Diets and habitats of jackrabbits within a shortgrass ecosystem. U.S. IBP Grassland Biome Tech. Rep. No. 98. Colorado State Univ., Fort Collins. 53 p.

Jackrabbit, Mammals, Food preference, Food consumption, Pawnee, Habitat

Black-tailed (*Lepus californicus*) and white-tailed (*Lepus townsendii*) jackrabbits play a large role in the utilization of vegetation within the shortgrass ecosystem. They affect the occurrence, abundance, and distribution of vegetation within their habitats.

Both hares demonstrated a high degree of preference for certain plant species. Western wheatgrass (*Agropyron smithii* Rydb.) was the most highly preferred plant by both species of jackrabbits. Four plant species comprised greater than 50% of the diets of hares for each season of the year. A total of 83 plant species were identified in the combined diets, and a total of 120 plant species were found in the combined habitats of the two species of jackrabbits. Fifteen plant species were intrinsic to the diets and 15 intrinsic to the habitats of black-tailed jackrabbits; 12 plant species were intrinsic to the diets and 10 intrinsic to the habitats of white-tailed jackrabbits.

TR099 Sims, P. L., D. W. Uresk, D. L. Bartos, and W. K. Lauenroth. 1971. Herbage dynamics on the Pawnee Site: Aboveground and belowground herbage dynamics on the four grazing intensity treatments; and preliminary sampling on the ecosystem stress site. U.S. IBP Grassland Biome Tech. Rep. No. 99. Colorado State Univ., Fort Collins. 95 p.

Pawnee, Aboveground plant biomass, Belowground plant biomass, Litter, Blue grama, Prickly pear, Ecosystem stress, Irrigation, Fertilization

Sampling on the grazing intensity treatments was much the same as in 1969. The methods for sampling aboveground and belowground herbage are included in Section I. Section II and Section III are figures and tables for the aboveground and belowground herbage dynamics, respectively. The descriptions of raw and "first pass" data for these figures are in Appendix A and B, respectively.

Preliminary sampling design for the ecosystem stress study site is in Section IV.

TR100 Flake, L. D. 1971. An ecological study of rodents in a short-grass prairie of northeastern Colorado. U.S. IBP Grassland Biome Tech. Rep. No. 100. Colorado State Univ., Fort Collins. 118 p.

Rodents, Mammals, Sex ratio, Feeding habit, Reproduction, Pawnee, Precipitation, Air temperature, Grazing influence, Food composition, Rodent population, Rodent embryo

Four rodent species (*Dipodomys ordii*, *Onychomys leucogaster*, *Peromyscus maniculatus*, and *Spermophilus tridecemlineatus*) were studied on the short-grass prairie of northeastern Colorado during 1969 and 1970 in conjunction with the International Biological Program's grassland biome studies. Three half-section pastures (intensive study pastures) subject to long-term cattle grazing at light, moderate, and heavy intensities, respectively, were live trapped to determine possible effects of grazing on rodent populations. Traps within each pasture were stratified into the three main soil types (Vona and Ascalon sandy loam, Midway-Renohill complex, and undifferentiated bottomland soils) to examine rodent abundance and distribution in relation to these soils. Live-trap data also provided information on sex ratios, annual population cycles, and population levels between years. Rodents were snap trapped in areas adjacent to the intensive study pastures and used for estimating litter size (embryo counts), reproductive seasons (presence of embryos, placental scars, and mean testis length), and sex ratios. Stomachs of snap-trapped rodents were collected and food habits examined using microscopic techniques. Habitat relations, reproduction, and food habits were emphasized in this study.

Populations of *P. maniculatus* were directly related to intensity of grazing pressure while *S. tridecemlineatus* were inversely related to intensity of grazing pressure, although the differences between pastures for both species were not great. *O. leucogaster* showed no definite relation to grazing pressure though populations were generally lowest in the heavily grazed pasture. Low sample size made relationship to grazing pressure, unless extreme, difficult or impossible to observe in *D. ordii*.

Definite soil relations were noted only in *O. leucogaster* and *D. ordii* as both showed an aversion for the undifferentiated bottomland soils, probably due to frequent flooding in this habitat, and in the case of *D. ordii*, lack of barren surface soil and thus dusting places. There were other less definite but probable soil relationships.

Pregnant *D. ordii* were found from February through August, *O. leucogaster* from March through August, *P. maniculatus* from February through November, and *S. tridecemlineatus* in May. Mean litter sizes and ranges were 2.87 (2-4), 4.58 (3-7), 4.70 (2-8), and 8.55 (7-11) for *D. ordii*, *O. leucogaster*, *P. maniculatus*, and *S. tridecemlineatus* respectively.

Mean percent volume of animal matter in diets of rodent species was as follows: *D. ordii* (4.4%), *O. leucogaster* (73.9%), *P. maniculatus* (39.0%), and *S. tridecemlineatus* (44.0%). Amounts of animal matter in adults and juveniles were about equal though there were some differences between sexes. The greatest amount of seasonal variation in percent volume animal matter in the diet was in *P. maniculatus*. Animal matter in the diets of all four species was composed almost entirely of arthropods with a few vertebrate parts present. Arthropods commonly identified in the diets included Coleoptera adults, Lepidoptera larvae, Coleoptera larvae, and grasshoppers (except in *D. ordii*). Plant matter in the diets of all species included unidentified seeds, leaves, stems, and flowering parts of various species of grasses and sedges, forbs, and shrubs and tissues of mosses, lichens, and fungi. Seeds were by far the most common type of plant matter in diets of *D. ordii* and *P. maniculatus* while plant matter in *S. tridecemlineatus* and *O. leucogaster* was more equally divided between seeds and non-seed parts of grasses (and sedges) and forbs. Much seasonal variation in types and relative amounts of different kinds of plant and animal matter was noted.

TR101 Mitchell, G. C. 1971. Spatial distribution and successional state of grassland vegetation related to grazing intensity treatments. U.S. IBP Grassland Biome Tech. Rep. No. 101. Colorado State Univ., Fort Collins. 70 p.

Pawnee, Plant pattern, Grazing influence, Succession, Blue grama, Prickly pear, Needleleaf sedge, Scarlet globe mallow

A study was conducted on the International Biological Program's (Grassland Biome) Pawnee Site to measure the pattern of several plant species in relation to grazing intensity. Five study sites were selected: a light grazed, a medium grazed, a heavy grazed, a 10-year exclosure and a 30-year exclosure. An analysis of variance procedure was used to determine the pattern scale and intensity of *Bouteloua gracilis*, *Carex eleocharis*, *Opuntia polyacantha*, and *Sphaeralcea coccinea*.

The five areas sampled were each determined to be in differing stages of secondary succession due to grazing pressure or lack of it. The four species selected for the pattern analysis were determined to be nonrandomly distributed. Small scale patterns which could be contributed to morphology and seed dispersal characteristics were exhibited by *O. polyacantha* and *S. coccinea*. At the medium scales the reciprocal pattern forced upon neighboring species by *O. polyacantha* seems to be dominant. Larger scale pattern was found but could not be attributed to grazing influences. The pattern intensity of all rhizomatous species decreased as the site approached a climax condition.

TR102 Harris, J. O. 1971. Microbiological studies at the Osage Site, 1970. U.S. IBP Grassland Biome Tech. Rep. No. 102. Colorado State Univ., Fort Collins. 39 p.

Osage, Bacteria population, Microbial biomass, Actinomycetes, Fungi, Decomposition, Decomposition cellulose, Decomposition plant, Soil respiration, Microflora, Respiration

A review is given of the 1970 microbiological investigations at the Osage Site. Data is presented covering microbial biomass measurements by the plate count and direct microscopic measurement of bacteria and actinomycetes, fungi decomposition rates of buried filter paper and standard litter samples, and respiratory activity by carbon dioxide release and oxygen uptake measurements.

TR103 Rice, R. W. and M. Vavra. 1971. Botanical species of plants eaten and intake of cattle and sheep grazing shortgrass prairie. U.S. IBP Grassland Biome Tech. Rep. No. 103. Colorado State Univ., Fort Collins. 21 p.

Cattle, Sheep, Fistula, Food composition, Digestion, Ingestion, Egestion, Grazing influence, Pawnee

Esophageal fistulated heifers were used to obtain samples of the diets of light and heavy use pastures. Esophageal fistulated heifers and sheep were used to collect dietary samples on the herbivore diet pastures. Grasses made up a major portion of the diet in 1970. They were relatively more important than in 1969. This was probably due to a reduced availability of forbs because of 1970 precipitation. Blue grama (*Bouteloua gracilis*) was the most important grass eaten. Other grasses of importance were western wheatgrass (*Agropyron smithii*), red threeawn (*Aristida longiseta*), and needle-and-thread (*Stipa comata*). The sedge, *Carex heliophila*, was also important. Forbs were less prominant in the diets of cattle on the light use pasture in 1970 than in 1969. Environmental limitations due to precipitation may have reduced the availability of forbs to cattle. Scarlet globemallow (*Sphaeralcea coccinea*) was again the most important forb and was apparently a preferred forb. Many other forbs were noticed in the diet, but were not of continued individual importance. Shrubs were a very minor component of the diet. Dietary crude protein was adequate throughout the summer. Dry matter digestibility declined through the season and was lower in July and August on the heavy use pasture. Dry matter intake and digestible energy intake increased seasonally. The intake per animal was lower in the heavy use pasture. Winter samples were collected in December of 1969. These indicate that winter diets include a much greater proportion of the half shrub fringed sagewort (*Artemisia frigida*) in the light use treatment, whereas shrubby plants on the heavy use pasture were not nearly as important. The thistle (*Cirsium undulatum*) was evidently eaten in unusual quantity in the heavy use pasture at the time winter samples were obtained.

TR104 Lloyd, J. E. and R. R. Grow. 1971. Soil macro-arthropods of the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 104. Colorado State Univ., Fort Collins. 18 p.

Pawnee, Soil fauna, Insects, Insect biomass, Grazing influence

The summer of 1970 was devoted to collection on a biweekly basis and identification of soil insects from the four differentially grazed pasture types. All organisms that were retained on a one millimeter sieve were considered macro-arthropods. Major insect groups collected and identified, in order of decreasing abundance were: Formicidae, Scarabaeidae, Staphylinidae, Rhinotermitidae, Tenebrionidae, Carabidae, Margarodidae, Curculionidae, Annelida, Asilidae, Elateridae, Lepidoptera, Lygaeidae, and Cerambycidae. Biomass and caloric values of the abundant groups will be determined.

TR105 Pieper, R. D., M. Connaughton, and R. Fitzenrider. 1971. Preliminary report on sampling of primary producers, invertebrates, and decomposers on the Jornada Site, 1970. U.S. IBP Grassland Biome Tech. Rep. No. 105. Colorado State Univ., Fort Collins. 47 p.

Jornada, Aboveground plant biomass, Belowground plant biomass, Litter, Insects, Insect density, Insect biomass, Bacteria population, Fungi population, Bacteria, Fungi, Microflora, Microbial population

Sampling for aboveground and belowground biomass of primary producers, litter, invertebrates, and decomposers was conducted at 10-day intervals on a grazed and protected area on the Jornada site. During the 1970 growing season, precipitation was below-average for the season, and most of the biological activity occurred during the major rainy period in the last week of July. Peak standing crop of aboveground biomass of primary producers occurred in mid-August on the grazed area and early September on the ungrazed area.

Invertebrate populations peaked on both grazed and ungrazed areas in late July. Insect numbers were consistently higher on the grazed area than on the ungrazed area. The order Acarina contained the greatest numbers of individuals. Decomposer biomass also peaked following the rains in late July.

TR106 Reuss, J. O. and P. W. Copley. 1971. Soil nitrogen investigations on the Pawnee Site, 1970. U.S. IBP Grassland Biome Tech. Rep. No. 106. Colorado State Univ., Fort Collins. 44 p.

Pawnee, Nitrogen fixation, Soil nitrogen, Nitrogen

Nitrogen fixation studies were conducted by an acetylene reduction technique on a variety of soil cores from the Pawnee Site under varying conditions of aeration, temperature, and energy supply. Both highly artificial, soluble energy source and anerobic conditions are required to achieve significant free living fixation. At saturation without artificial energy source, a maximum of a few g/ha/day are fixed. At field moisture, fixation is less than 1 g/ha/day. Under otherwise favorable conditions, a temperature regime of 0°C during the night and 16°C during the day essentially stopped fixation; and, when temperatures were increased, fixation was much less than in soils not subjected to cold treatment. Fixation rates on single potted legume plants were highly reproducible. No N fixation could be detected in pond waters.

Sampling variability studies indicate a high variability in total N content between similar soil mapping units at different locations. Where fertilizer N was spring applied at the rate of 150 kg/ha, an average of 60 kg/ha remained as mineral N in the top 40 cm of soil. A few measurements of N in precipitation averaged about 1 ppm N.

TR107 Lavigne, R. J., L. E. Rogers, and J. Chu. 1971. Data collected on the Pawnee Site relating to western harvester ant and insect predators and parasites, 1970. U.S. IBP Grassland Biome Tech. Rep. No. 107. Colorado State Univ., Fort Collins. 96 p.

Pawnee, Ant, Predation, Parasites, Food composition, Insects, Insect biomass, Respiration, Energy flow, Food web, Insect respiration

This technical report presents data concerning the role of the western harvester ants (*Pogonomyrmex occidentalis* Cresson) and the robber flies (Asilidae) in the grassland ecosystem. Other general data are presented concerning the parasitism rate of grasshoppers and the population fluctuations of other insect predators.

TR108 Hulett, G. K. and G. W. Tomanek. 1971. Herbage dynamics on a mixed prairie grassland near Hays, Kansas. U.S. IBP Grassland Biome Tech. Rep. No. 108. Colorado State Univ., Fort Collins. 35 p.

Hays, Precipitation, Wind, Air temperature, Atmospheric water, Aboveground plant biomass, Belowground plant biomass, Standing dead, Litter

Specific objectives of the project included: (i) to estimate the net primary production of shoot and roots, (ii) to estimate standing dead and mulch standing crops, and (iii) to estimate the caloric content of biomass components. Data were collected from an ungrazed and a grazed site on a typical *Andropogon-Bouteloua* community. Peak standing crop of green herbage varied from 222 g/m^2 on the ungrazed prairie (July 17) to 243 g/m^2 on the grazed area (July 2). Average productivity rate varied from 2.10 g/m^2/day on the grazed area. Average standing dead for the ungrazed treatment was 123 g/m^2 while for the grazed treatment it was 84 g/m^2. Mulch estimates varied from a mean of 1,031 g/m^2 on the ungrazed to 375 g/m^2 on the grazed. Peak root standing crops of 1,500 to 1,600 g/m^2 occurred in summer and low root standing crops of 446 to 454 g/m^2 occurred during fall and early winter.

Further analysis of data will allow us to attempt estimates of compartmental transfer rates and also report calorific data.

TR109 Hoffmann, R. S., J. K. Jones, Jr., and H. H. Genoways. 1971. Small mammal survey on the Bison, Bridger, Cottonwood, Dickinson, and Osage Sites. U.S. IBP Grassland Biome Tech. Rep. No. 109. Colorado State Univ., Fort Collins. 69 p.

Bison Site, Bridger, Cottonwood, Dickinson, Osage, Mammals, Jackrabbit, Pocket gopher, Grazing influence, Vole, Mammal biomass, Ground squirrel, Mammal population, Species diversity

Live- and snap-trapping of grids at five Network Sites on the northern Great Plains (Osage, Cottonwood, Dickinson, Bridger, and Bison) provide the basis for estimates of small mammal standing crop biomass density at one or two times during the growing season at these sites.

Osage had a high prairie vole (*Microtus ochrogaster*) population, comprising about 90% of the biomass total, in late May to early June. Biomass density was calculated as 1591.4 g/ha live weight (=0.048 g/m^2 dry weight). Vole numbers declined somewhat over the summer, but still constituted 80 to 85% of the biomass total in late August; biomass density was estimated as 1121.7 g/ha live weight (=0.034 g/m^2 dry weight).

Small mammal densities were extremely low in both mid-June and mid-August at Cottonwood, and no one species was dominant. Biomass density estimates were 114.8 g/ha live weight (=0.003 g/m^2 dry weight) and 181.2 g/ha live weight (=0.005 g/m^2 dry weight), respectively.

Densities also were fairly low at Dickinson, with no dominant species; biomass density in mid-June was estimated as 295.0 g/ha live weight (=0.009 g/m^2 dry weight), and in early August as 369.3 g/ha live weight (=0.011 g/m^2 dry weight). However, biomass density estimates based on live-trapping an irregular grid in a small exclosure were much higher because of the presence in the exclosure of a ground squirrel (*Spermophilus tridecemlineatus*) colony. Ground squirrels constituted 75 to 85% of the biomass total, estimated as 2464.0 g/ha live weight (=0.075 g/m^2 dry weight) and 976.0 g/ha live weight (=0.029 g/m^2 dry weight) for the first and second periods, respectively.

Only single mid-season samples were taken at Bridger and Bison. At the former site, biomass density was moderate to high because of pocket gophers, which constituted 60 to 90% of the biomass total of 2375.8 g/ha live weight (=0.071 g/m^2 dry weight) on the snap-trapped grid, and 358.1 g/ha live weight (=0.011 g/m^2 dry weight) on the live-trapped grid. At Bison, the montane vole (*Microtus montanus*) constituted 90% of the biomass total of 397.4 g/ha live weight (=0.012 g/m^2 dry weight).

TR110 Klein, D. A. 1971. Microbial decomposer activities at the Pawnee Site: Integration of experimental approaches with program modelling requirements. U.S. IBP Grassland Biome Tech. Rep. No. 110. Colorado State Univ., Fort Collins. 29 p.

Pawnee, Protozoa, Soil respiration, Soil biochemistry, Microbial activity, Fungi, Actinomycetes, Respiration, Microflora

Experimental procedures which will allow modelling of Pawnee soil decomposer responses have been tested during this research period, and results are discussed in relation to general soil biochemical considerations and specific characteristics of the grassland ecosystem. Procedures for measurement of respiration and mineralization which are recommended include macro-respirometry and an *in situ* spatially-oriented dehydrogenase assay. Combined with measurement of evolved carbon dioxide, these procedures give baseline responses for test soils. Plating enumerations for total bacteria, actinomycetes, and fungi have been tested together with Most Probable Number (MPN) nitrifier and amoebal protozoan assays. Soils have been perturbed by variations in temperature, and by moisture, glucose, control hay, and extracted hay additions. Results are discussed in relation to parameters of nitrogen and phosphorus additions planned for future experiments. Progress to date in modelling of decomposer functions is presented.

Results from this research period indicate that sensitive, inexpensive procedures are now available for characterization and modelling of grassland decomposer functions.

TR111 Lewis, J. K., J. L. Dodd, H. L. Hutcheson, and C. L. Hanson. 1971. Abiotic and herbage dynamics studies on the Cottonwood Site, 1970. U.S. IBP Grassland Biome Tech. Rep. No. 111. Colorado State Univ., Fort Collins. 147 p.

Cottonwood, Precipitation, Air temperature, Atmospheric water, Soil water, Aboveground plant biomass, Belowground plant biomass, Standing dead, Litter, Litter accumulation, Primary production, Soil temperature

Above- and below-ground herbage biomass, mulch, and abiotic factors were studied in a permanent exclosure in high range condition and in a temporary exclosure in low range condition at the Cottonwood Range Field Station, 75 miles east of Rapid City. The permanent exclosure was fenced from a pasture with a history of light grazing in 1963. This area appears to be approaching stability. The temporary exclosure was fenced from a pasture with a history of heavy grazing in the spring of 1970. Both exclosures are located on gentle, northeasterly slopes with silty clay soils. Mean annual precipitation is 15.1 inches of which about 75% is received from April through September.

Precipitation, evaporation, evaporation pan wind movement, and soil temperatures at 10, 20, 50, 100, and 150 cm were measured daily in exclosures near to and very similar to the study areas. Total solar radiation, wind movement and wind direction at 2 m, air temperature and relative humidity in a standard weather bureau instrument shelter were measured daily near the study areas. Soil moisture was determined gravimetrically on the clip plots at each sample date by 10 cm increments to 60 cm. Heavy snow in April resulted in total soil water to 60 cm of about 21 cm in both exclosures in early May, decreasing steadily to about 11 cm on September 2 with brief recharge in early July and early August with a significant increase in the fall. Precipitation for the year was 2.92 inches below normal.

Above-ground herbage biomass was estimated at approximately 2-weekly intervals from May 8 through September 4 and at about monthly intervals from September 4 through December 4 by clipping 10 0.5 m^2 plots in each of two replications in each of the two exclosures. Botanical composition by species separated as live, this year's (recent) dead, standing (old) dead, and live and dead crowns and stolons was estimated in the laboratory. The dominant species was *Agropyron smithii* in high range condition and *Buchloe dactyloides* in low range condition. In the high range condition exclosure, the standing crop of live plus this year's dead of all species increased to a peak of 199 g/m^2 in late July and to a second peak of 210 in early September while the low range condition exclosure increased to a peak of 137 g/m^2 in late July, declined in early August, increased to 139 g/m^2 in late August and then declined. Mulch was vacuumed from the plots and estimated as fresh and humic. Fresh mulch increased from 155 g/m^2 oven dry, ash-free weight in early May to 1361 in late July and then declined in the high range condition exclosure, while in low range condition it increased from 58 to 168 g/m^2 in late June, declined, increased to 160 in early August and then steadily declined. In high range condition, humic mulch increased from 63 to 111 g/m^2 in late May, behaved erratically and then declined. In low range condition it increased from 37 to 85 g/m^2 in early July and then declined erratically.

Below-ground plant weight was measured by taking 10 4.2 cm cores to a depth of 60 cm in each clipped plot at monthly intervals. Cores were cut into 0-5, 5-10 and then into 10 cm segments to 60 cm. Below-ground plant weight was prodominantly roots, although below-ground crowns and rhizomes were present. In the high range condition exclosure, total roots, live plus dead to 60 cm, increased from 934 g/m^2 oven dry, ash-free weight in early May to a peak of 1193 g/m^2 in early July. In the temporary exclosure, root weight increased from 1842 g/m^2 in early May to a peak value of 2227 in early July. In both exclosures, values declined after the peak and increased until early November. Forty-six and 44% of the total root weight was in the top 10 cm in the high and low range condition exclosures, respectively. Root turnover calculated from the biomass values was .16 and .25 for the high and low range condition exclosures, respectively. During the year below-:above-ground plant standing crop ratios ranged from 1:1 to 3:1 and from 4:1 to 7:1 in high and the low range condition exclosures, respectively.

TR112 McDaniel, B. 1971. Studies of populations of adults and immature insects and mites from two treatments at Cottonwood, South Dakota. U.S. IBP Grassland Biome Tech. Rep. No. 112. Colorado State Univ., Fort Collins. 79 p.

Cottonwood, Insects, Ant, Insect population, Insect density, Chewing arthropods, Sucking arthropods, Diplopods, Collembolans

Arthropod samples collected periodically during the months of May through August 1970 yielded information on the population trends of various groups of invertebrates. Six orders of insects make up the greater density of the invertebrates in both treatments studied. The large number of Hymenoptera is due to the presence of ants. During the month of May, a total of 32,995 individuals were collected and distributed among 13 orders of the class Insecta, the Acarina, Araneae, Diplopoda, and Chilopoda. A total of 12,297 of these were collected from the grazed treatment and 20,698 from the ungrazed treatment. In June only 7,963 individuals were obtained among 14 orders of Insecta, the Arachnida, and Diplopoda. The grazed treatment contained 4,514 individuals, while 3,449 specimens were obtained from the ungrazed treatment. The month of July is evaluated on the basis of one sample date with a total of 9,185 specimens collected. The grazed treatment contributed 5,914 individuals and the ungrazed treatment only 3,271 specimens. These were distributed in 12 orders of the Insecta, the Arachnida, Diplopoda, and the Chilopoda. The month of August contributed a total of 21,028 individuals in 10 orders of the Insecta, and the Arachnida. The grazed treatment had 13,183 individuals while the ungrazed treatment contained 7,845 specimens.

TR113 Morris, M. S. and J. D. Brunner. 1971. Primary productivity of the fescue grassland in western Montana. U.S. IBP Grassland Biome Tech. Rep. No. 113. Colorado State Univ., Fort Collins. 74 p.

Bison Site, Precipitation, Air temperature, Soil temperature, Wind, Atmospheric water, Soil physical characteristics, Soil water, Leaf height, Aboveground plant biomass, Belowground plant biomass, Standing dead, Litter, Phenology, Primary production, Texture

A study of primary productivity in the Fescue Grassland in western Montana was conducted on the National Bison Range northwest of Missoula, Montana in 1970. A comparison of two vegetation conditions was made. They are: a stand dominated by a rough fescue (*Festuca scabrella* Torr.) with a grazing history of light to no use in most years and a mixed stand of Idaho fescue (*F. idahoensis* Elmer) and bluebunch wheatgrass [*Agropyron spicatum* (Pursh) Scrib. and Smith] with a grazing history of moderately close use and both stands on comparable sites. Air and soil temperatures, relative humidity, precipitation, wind velocity, and soil moisture characteristics of the environment were monitored. Height growth, plant moisture content, and phenology were recorded. Biweekly harvesting of .5 m^2-plots was initiated in April and continued to October. Separation of aboveground plant biomass components was made, including 1970 standing green, 1970 standing dead, and 1969 standing dead and litter. Moss and belowground plant biomass were single date determinations. Total plant biomass was 3170 and 1728 g/m^2 for the light and moderately close grazed treatments, respectively. Net primary production was 531 and 298 g/m^2, respectively. While growth is initiated in the fall of the previous year, significant spring growth requires daily mean temperatures of over 5°C. Soil moisture stress at -15 bars terminated growth by July 3 under both treatments. Efficiency in utilization of precipitation is a more realistic measure of the use of the environmental resources than use of radiant energy.

TR114 Packard, R. L. 1971. Small mammal survey on the Jornada and Pantex Sites. U.S. IBP Grassland Biome Tech. Rep. No. 114. Colorado State Univ., Fort Collins. 48 p.

Jornada, Pantex, Mammals, Rodent, Rodent density, Rodent biomass, Pocket mouse, Jackrabbit

This summarizes the small mammal survey on the Jornada and Pantex study sites in the comprehensive network of the U.S. IBP Grassland Biome. A total of 371 small mammals were marked by live-trapping, and 301 small mammals were collected from snap-trapping. These animals provided data on density and biomass. Three sampling periods (spring, summer, autumn) provided comparative population and biomass data. Biomass for all species of small mammals varied from 2621 g/ha to 1130 g/ha on the Jornada, whereas at Pantex, biomass varied from 908 g/ha to 584 g/ha.

TR115 Van Haveren, B. P. and A. F. Galbraith. 1971. Some hydrologic and physical properties of the major soil types on the Pawnee Intensive Site. U.S. IBP Grassland Biome Tech. Rep. No. 115. Colorado State Univ., Fort Collins. 46 p.

Pawnee, Soil types, Hydrology, Soil physical characteristics, Soil water, Water potential, Runoff, Snow, Watershed, Bulk density, Texture

Experimental design of the soil water transect study is discussed in some detail. Soil bulk density, texture, and water retention data for the soil water transects and irrigation plots are presented. Preliminary water content data collected at the end of the 1970 growing season are also shown and discussed. Observations on snow accumulation and associated soil water recharge are introduced and discussed briefly. Results of the textural analysis, pore space distribution, and water desorption characteristics of the microwatershed soils are presented. The calibration results for the neutron probe are also given.

TR116 Whitman, W. C. 1971. Primary productivity and abiotic studies at the Dickinson Site, 1970 season. U.S. IBP Grassland Biome Tech. Rep. No. 116. Colorado State Univ., Fort Collins. 100 p.

Dickinson, Precipitation, Soil water, Air temperature, Soil temperature, Net radiation, Wind, Atmospheric water, Bulk density, Solar radiation, Soil heat flux, Plant checklist, Phenology, Leaf height, Aboveground plant biomass, Belowground plant biomass, Litter, Standing dead, Yield

This report describes the methods used in the study of primary productivity and abiotic influences on grazed and ungrazed treatments at the Dickinson Site in the 1970 season and gives a summary of the data obtained in the field during the study period. The general abiotic data provided include precipitation, soil moisture, soil and air temperatures, net radiation, soil heat flux, wind movement, and relative humidity on both treatments. The primary productivity data include data from vegetation clippings made at essentially two-week intervals throughout the growing season from May 25 through August 18, supplemented with clippings on September 17 and October 17. Underground biomass data were obtained from core samples taken to a depth of 1 m at the same time that clippings were made. Results obtained show the grazed site to have warmer soil and air temperatures, greater wind movement, slightly less favorable soil moisture conditions, less energy utilization, and nearly equal atmospheric moisture conditions as compared to the ungrazed site. The maximum standing crop on the ungrazed area was over 50% larger than on the grazed area. Standing dead material on the grazed area was only 13% of that on the ungrazed area, while litter on the grazed area was less than one-third that on the ungrazed area. Belowground biomass was greater under the grazed treatment than under the ungrazed, averaging 53% greater dry weight for the season.

TR117 Francis, R. C., C. V. Baker, G. M. Van Dyne, and J. D. Gustafson. 1971. A study of the weight estimation method of botanical analysis. U.S. IBP Grassland Biome Tech. Rep. No. 117. Colorado State Univ., Fort Collins. 147 p.

Pawnee, Weight estimate method

The weight estimate method of determining standing crop by species is reviewed and applied to data from the Pawnee Site of the IBP Grassland Biome. The procedure is evaluated as a double sampling technique for reducing the variance for a fixed cost of the estimate of aboveground plant biomass by species, over the standard plot-clipping procedure. Two statistical estimators (regression and ratio) are used. In addition, a computer simulation model of the estimation procedure is developed in order to study the distributional properties of the two double sampling estimators. Double sampling is effective in reducing the variance of the estimate in a majority of the cases tested.

TR118 Mitchell, J. E. 1971. Consumption and metabolic rates of some leaf-eating, chewing arthropods: A summarized literature review. U.S. IBP Grassland Biome Tech. Rep. No. 118. Colorado State Univ., Fort Collins. 4 p.

Chewing arthropods, Competition, Metabolic rate, Respiration, Insect biomass, Insect density, Ingestion, Insect respiration

A table, comprised of consumption rates and metabolic rates of selected phytophagous chewing arthropods, is presented. The data were derived from a literature review and are primarily intended for the information of the modellers and others interested in approximate values of these parameters.

TR119 Harris, L. D. and G. L. Swartzman. 1971. A preliminary model for consumer predation. U.S. IBP Grassland Biome Tech. Rep. No. 119. Colorado State Univ., Fort Collins. 27 p.

Models, Consumer model, Consumer predation model, Predation

In this paper a generalized multi-species consumer predation model is developed. Predatation is seen as a function of kill rate.

predator preference, and prey numbers. Consideration is made in the model for predator abundance, predator switching to different prey, prey abundance, and cover conditions. Kill rate also includes information about relative predator and prey advantages. The model is compared with previous models, and some of the matrices are derived from Pawnee Site data to relate the model to a specific example.

TR120 Bauerle, B. 1971. Snakes and lizards of the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 120. Colorado State Univ., Fort Collins. 47 p.

Pawnee, Reptiles, Lizard, Snake, Snake biomass, Snake density, Reptile biomass, Reptile density, Reptile growth, Lizard biomass, Lizard density

Some 167 snakes were marked and released on the intensive study site during the study period of 1970. The four most numerous species present were:

i. the prairie garter snake, (*Thamnophis radix*), 140 specimens;
ii. the gopher (bull) snake, (*Pituophis catenifer*), 13 specimens;
iii. the prairie rattlesnake, (*Crotalus viridis*), 8 specimens; and
iv. the western hog-nosed snake, (*Heterodon nasicus*), 6 specimens.

In addition to these, 27 prairie rattlesnakes (*C. viridis*) were collected near the intensive study site for egg counts, fat body weights, dry weights, and ash weights. Continuous trapping by using drift fence-funnel traps was the most effective collecting method for snakes. However, most garter snakes were caught by hand. Snake populations on the intensive site, except immediately around Cottonwood Pond, were low according to the methods used. Initial data indicates a standing crop of between 100 and 300 g of snake per hectare over most of the site. The standing crop around the only permanent water at the site (Cottonwood Pond) was calculated to be nearly 8 kg/ha. Sex ratios of trapped and captured snakes were nearly equal for all four species. In the spring of 1970 the prairie rattlesnakes (*C. viridis*) and the plains garter snakes (*T. radix*) emerged from dens between May 1 and May 4. No snakes were collected after October 20, 1970. The plains garter snake (*T. radix*) began breeding between May 18 and May 24. The prairie rattlesnake (*C. viridis*) was shown to have mature appearing eggs present in the body in both May and October, 1970. Two recaptures of plains garter snakes (*T. radix*) occurred over a long enough period to show weight increases. Egg counts varied from 9 to 37 eggs per female. Growth curves of all four species have been presented in the data section. Length was plotted against weight for snakes collected during the summer of 1970. Coefficient of correlation of length to weight was +.82 on the plains garter snakes (*T. radix*), and coefficient of correlation of length to weight on prairie rattlesnakes (*C. viridis*) was +.85. Numbers of individuals of the other two species were so low as to not warrant correlation coefficients. There was great variation in the amount of stored fat in both emerging and denning snakes. No significant difference was found in the amount of fat per body weight in the spring collected snakes, when compared to fall collected snakes. This study is the initial phase of a two year investigation concerning the role of snakes in the Grassland Biome.

TR121 Peden, D. G. 1971. Preliminary activities and results in bison research on the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 121. Colorado State Univ., Fort Collins. 8 p.

Pawnee, Bison, Mammals, Rumen, Fistula, Ingestion, Digestion, Food composition

This report covers activities and preliminary results of the bison project during the period between September 1969 and early 1971. Data given herein pertain to that collected at the U.S. IBP Grassland Biome Site, Pawnee. A general outline for 1971 collections is given.

TR122 Dittberner, P. L. 1971. Soil nutrient-plant nutrient relationships at the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 122. Colorado State Univ., Fort Collins. 34 p.

Pawnee, Blue grama, Wheat, Aboveground plant biomass, Belowground plant biomass, Soil chemical characteristics, Soil physical characteristics, Texture

This investigation was initiated to study the soil nutrient-plant nutrient relationships of blue grama (*Bouteloua gracilis* (H.B.K.) Lag. ex Steud.) and wheat (*Triticum aestivum* Z.). This report includes methodology of data collection and the results of chemical analysis for the soil samples.

TR123 Dickinson, C. and J. Leetham. 1971. Aboveground insects on the Pawnee Site, 1970. U.S. IBP Grassland Biome Tech. Rep. No. 123. Colorado State Univ., Fort Collins. 9 p.

Pawnee, Insects, Ant, Leafhopper, Insect biomass, Insect density

Biweekly aboveground insect samples were collected on the Pawnee Site from April through October 1970. Numbers and weights of insects by taxa were recorded in the Grassland Biome data bank. Principal groups present were ants (Formicidae) and leafhoppers (Cicadellidae).

TR124 Blocker, H. D., R. Reed, and C. E. Mason. 1971. Leafhopper studies at the Osage Site (Homoptera:Cicadellidae). U.S. IBP Grassland Biome Tech. Rep. No. 124. Colorado State Univ., Fort Collins. 25 p.

Osage, Leafhopper, Insects, Insect checklist, Leafhopper checklist, Parasites, Insect biomass

At least 38 species of leafhoppers have been identified from the Osage Comprehensive Network Site. Evidence, obtained through comparative collecting methods and "escape tests," is presented to show that collecting methods need alteration. Information is presented on biomass and numbers of leafhoppers; an annotated list of species is included and recommendations for future research are given. Additional information on parasitism and other general ecological information is included.

TR125 Wright, R. G. [Compiler]. 1971. Curriculum vitae of scientists to participate in the U.S. IBP Grassland Biome Studies proposed for 1972 and 1972. U.S. IBP Grassland Biome Tech. Rep. No. 125. Colorado State Univ., Fort Collins. 266 p.

Personnel vitae

This report is intended to serve as a directory of all participants for the proposed U.S. IBP Grassland Biome studies in 1972 and 1973. All entries in this report are in alphabetical order, and are written in a comparable format and contain background information on academic training and professional experience, major interests, professional activities, and all publications and technical reports. Preceding the individual vitae is an overall list of all participants contained herein, together with their formal organizational affiliation.

TR126 Turner, J. and R. M. Pengra. 1971. Decomposer studies at the Cottonwood Site. U.S. IBP Grassland Biome Tech. Rep. No. 126. Colorado State Univ., Fort Collins. 15 p.

Cottonwood, Soil respiration, Litter decomposition, Decomposition, Decomposition litter, Decomposition cellulose, Respiration

Carbon dioxide collection and measurement for a known surface area and time period was made in an attempt to assess decomposer activity under good and poor range conditions. Data collected and the method employed have aided in devising methods that will be more quantitative for use in subsequent studies.

Through litter and filter paper studies we have also developed and adapted methods to be used in further studies of decomposer activity at the Cottonwood Site.

TR127 Rasmussen, J. L., G. Bertolin, and G. F. Almeyda. 1971. Grassland climatology of the Pawnee Grassland. U.S. IBP Grassland Biome Tech. Rep. No. 127. Colorado State Univ., Fort Collins. 79 p.

Pawnee, Climate, Topography, Precipitation, Solar radiation, Wind, Air temperature

This report is presented in two parts: first, an analysis of historical data provides a climatological summary principally concerning precipitation and temperature of the Pawnee Grassland; and second, an analysis of historical data describes the solar radiation distributions in time and space over the North American grassland region.

Part I

A study of the climate of the Pawnee National Grassland, of northeastern Colorado is presented. The analysis concentrated on temperature and precipitation using historical data available from climatological weather stations. Spatial and yearly precipitation variability within the Pawnee Grassland is examined. A storm analysis is described in which summer storms producing more than one inch of rainfall are shown to be an important factor in the yearly precipitation variability. An extreme value analysis was performed on storm precipitation. A two-state, first-order Markov chain was used to calculate precipitation probabilities.

The temperature analysis is based upon maximum and minimum daily temperatures. Results include seasonal temperature variation, diurnal temperature variation, extreme value temperature analysis, length of growing season, and monthly range of temperature. Probabilities are calculated with a three-state first-order Markov chain so that sequences of temperature may be generated.

Through correlation studies, yearly variations in precipitation, wind, and temperature are shown to be related.

Part II

The spatial and temporal changes in incoming solar radiation are summarized for fourteen stations of the west-central United States. The area encompassed is within 97° to 118° west longitude and 33° to 49° north latitude. The period of study covers twenty years, 1950 through 1969. Deviations from long-term station monthly means are used as a basis for this analysis in order to minimize interstation calibration problems. The average monthly deviations of the area are accumulated for annual totals. The results of the analysis show that there is a trend in the average annual radiation received over the area amounting to a 725 langley decrease per year (0.5% decrease per year). The magnitude of this trend is stronger in the southern latitudes of the study area and is most pronounced in the summer months. Variations superimposed upon the trend are investigated and shown to be correlated with the relative annual average cloudiness. The effects of volcanism and extraterrestrial forces, e.g., solar cycle variations, are discussed.

TR128 Hyder, D. N., K. L. Knox, and C. L. Streeter. 1971. Metabolic components of cattle under light and heavy rates of stocking in 1970. U.S. IBP Grassland Biome Tech. Rep. No. 128. Colorado State Univ., Fort Collins. 42 p.

Pawnee, Cattle, Water turnover, Urine output, Egestion, Ingestion, Stocking rate, Fistula, Cattle biomass, Mammals, Calorimetry, Metabolism, Cattle growth, Digestion, Nitrogen, Goat, Excretion

The work on metabolic components of cattle was conducted on pastures which were stocked lightly (23W) and heavily (23E) in 1970. Animal liveweights and animal days of grazing were monitored throughout the six months of warm-season grazing. After the completion of facilities, drinking water containing tritium, lithium, and chromium-EDTA was metered individually to fistulated animals and collectively to herd animals. Samples of urine and feces were collected daily and composited by weeks for determinations of tracer concentrations and various chemical components. Forage intake was estimated in three different ways, and dry matter digestibility was estimated by a fecal-nitrogen index equation. Under light stocking there were 20.8 animal days of grazing per hectare, during which about 130 kg/ha of forage dry matter was harvested. Under heavy grazing there were 40.9 animal days of grazing per hectare, during which about 257 kg/ha of forage dry matter was harvested.

TR129 Savić, I. R. and F. B. Golley. 1971. Bibliography on the species and genus *Sigmodon* (Cricetidae, Rodentia). U.S. IBP Grassland Biome Tech. Rep. No. 129. Colorado State Univ., Fort Collins. 44 p.

Mammals, Rodent, *Sigmodon*

Sigmodon are abundant mammals in grass and herb dominated communities in southern United States. They serve as an important link in the complex of natural food-chains, and may be significant in the spread of parasites on infective diseases. Because of their importance, a relatively large literature has developed which reports data on the life history, taxonomy, physiology, health, and ecology of the genus. *Sigmodon* have also been adopted as a laboratory animal for medical studies. We have prepared this bibliography on *Sigmodon* as an aid to further research.

TR130 Grant, W. E. 1971. Comparisons of small mammal biomass at eight U.S. IBP Grassland Biome research sites, 1970 season. U.S. IBP Grassland Biome Tech. Rep. No. 130. Colorado State Univ., Fort Collins. 19 p.

Intersite comparison, Mammals, Mammal biomass, Mammal density

Small mammal population density estimates are made for Bison, Bridger, Cottonwood, Dickinson, Jornada, Osage, Pantex, and Pawnee sites based on 1970 field data. Small mammal biomass at these sites is quantitatively compared by means of a similarity index and cluster analysis.

TR131 Grant, W. E. 1971. Comparisons of aboveground plant biomass on ungrazed pastures vs. pastures grazed by large herbivores, 1970 season. U.S. IBP Grassland Biome Tech. Rep. No. 131. Colorado State Univ., Fort Collins. 19 p.

Plant checklist, Grazing influence, Aboveground plant biomass, Intersite comparison

This report presents a comparison of floral composition (live aboveground biomass) between different grazing treatments at nine U.S. IBP Grassland Biome research sites. A similarity index developed by Shannon and Weaver (1949) is used to compare ungrazed pastures to those grazed by large herbivores based on data collected in 1970 at the nine sites. The data indicate that the proportional plant species composition is relatively unaltered significantly. One site is intermediate to the two groups mentioned above.

TR132 Van Haveren, B. P. 1971. Psychrometry in water relations research: A review. U.S. IBP Grassland Biome Tech. Rep. No. 132. Colorado State Univ., Fort Collins. 43 p.

Symposia report, Blue grama, Light spectrum, Reflectivity, Cover, Plant cover, Instrumentation, Spectrophotometer lab

The Symposium on Thermocouple Psychrometers: Theory and Applications to Water Relations Research was held at Utah State University on March 17, 18, and 19, 1971. The Symposium was cosponsored by the U.S. International Biological Program, Grassland and Desert Biomes, and the Intermountain Forest and Range Experiment Station, U.S. Department of Agriculture, Forest Service. The general themes of the Symposium were the theory and techniques involved in the use of psychrometric instrumentation in water relations research. Some 33 technical papers were presented at the three-day meeting. The Proceedings has been accepted for publication by the Utah Agricultural Experiment Station and will be available late in 1971. The Symposium was dedicated in memory of the late Dr. Sterling A. Taylor, Professor of Soil Physics, Utah State University.

TR133 Pearson, R. L. and L. D. Miller. 1971. Design of field spectrophotometer lab. U.S. IBP Grassland Biome Tech. Rep. No. 133. Colorado State Univ., Fort Collins. 102 p.

Instrumentation, Pawnee, Spectrophotometer lab, Reflectivity, Computer programs

The IBP Grassland Biome Program of the National Science Foundation has funded a ground based remote sensing study of the feasibility of determining the percent cover of standing green vegetation for a shortgrass prairie ecosystem by measuring the spectroreflectance of an undisturbed patch of vegetation. The equipment assembled for this study include: a spectroradiometer, with telescope viewing optics; a computer based digital data acquisition system; and calibration and logistical support systems. The determination of spectroreflectance is made by measuring with the spectroradiometer the spectroradiance reflected from a white panel painted with barium sulfate and then measuring the spectroradiance reflected from the 'in situ' sample. The ratio of these two spectroradiances at each wavelength is the spectroreflectance of the sample. Several tests have been completed which assess the suitability of the spectroradiometer for measuring spectroreflectance of various objects as well as determining percent cover of prairie vegetation.

TR134 Baldwin, P. H. 1971. Diet of the Mountain Plover at the Pawnee National Grassland, 1970-1971. U.S. IBP Grassland Biome Tech. Rep. No. 134. Colorado State Univ., Fort Collins. 34 p.

Mountain Plover, Pawnee, Food composition, Birds

The diet of the Mountain Plover (*Eupoda montana*) in Weld County, Colorado, was studied for the spring and summer period between the dates May 4 and August 11. Thirteen birds, eight adult and five juveniles, were available for analysis of stomach contents. Identifications of 90 food taxa and estimates of dry weight parameters for each type of food showed the diet to consist of 99.7% arthropods and 0.3% seeds. The most important food types were ground-dwelling beetles (60.0%), grasshoppers and crickets (24.5%) and ants (6.6%). The most important genus eaten was *Eleodes* (a darkling beetle) comprising 22% of the diet. Comparisons of diets of juvenile and adult Mountain Plover revealed that juveniles ate smaller insects such as ants, bees, wasps and parasites, leaf and flower beetles, and leafhoppers in slightly greater proportions than did adults. Adults, however, ate larger insects such as caterpillars, billbugs, and darkling beetles in somewhat greater proportions than did juveniles. The mean length of food items eaten by all adults was 10.0 mm, and by juveniles 8.5 mm. Overlap in size, i.e., length of food items eaten by the two age groups, was 60.3%.

TR135 Baldwin, P. H. 1971. Diet of the Killdeer at the Pawnee National Grassland and a comparison with the Mountain Plover, 1970-1971. U.S. IBP Grassland Biome Tech. Rep. No. 135. Colorado State Univ., Fort Collins. 22 p.

Pawnee, Mountain Plover, Killdeer, Birds, Food composition .

The diet of the Killdeer (*Charadrius vociferus*) in shortgrass prairie of Weld County, Colorado, was studied for the summer period, June 16 to July 28. A similar bird, the Mountain Plover (*Eupoda montana*), also feeds in the same shortgrass prairie during this period, so the two diets were compared to determine the amount of overlap. The food of the Killdeer was 99.7% animal in nature and 0.3% plant on the basis of biomass consumed. Types of food eaten in greatest quantities were ground-dwelling beetles (77.0%), aquatic arthropods (13.6%), and crickets (5.0%). The most important family was the Carabidae (33.0%), and the second was the Tenebrionidae (26.3%). The mean length of food items eaten by the Killdeer was 8.0 mm, and the mean dry weight was 0.01 g.

The diets of Killdeer and Mountain Plover showed much overlap. Each bird obtained 77.3% of its food biomass from taxa eaten also by the other bird. Most of the overlap was from consumption of ground-dwelling beetles by both birds. The use of aquatic beetles by the Killdeer accounted for much of the non-overlapping foods. The similarities in diet resulted mainly from both birds feeding in the dry, upland shortgrass vegetation; the differences resulted from the Killdeer feeding frequently at water and on damp ground.

TR136 Baldwin, P. H., P. D. Creighton, and D. S. Kisiel. 1971. Diet of the Mourning Dove at the Pawnee National Grassland, 1970-1971. U.S. IBP Grassland Biome Tech. Rep. No. 136. Colorado State Univ., Fort Collins. 25 p.

Pawnee, Birds, Mourning Dove, Food consumption

The diet of the Mourning Dove (*Zenaidura macroura*) was studied for the spring and summer months of 1970 and 1971. Thirty-one birds, 28 adults and 3 juveniles, were collected for analysis of the stomach contents. Identification of 45 food taxa and estimates of dry weight parameters showed the diet to consist of over 99.9% seeds and less than one-tenth of one percent arthropods and molluscs. The most important food types were bee plant (*Cleome serrulata*) (28.1%), grasses (24.3%) and composites (19.6%). Almost 76% of the Mourning Dove diet was composed of seeds from plants characteristic of disturbed habitats, i.e., roadsides, cultivated and abandoned fields. Comparisons of adult and juvenile diets during mid-summer revealed that juveniles ate mainly composites and grasses (96%), while adults consumed seeds of bee plant and spiderwort (*Tradescantia occidentalis*) (68%). Selection of seed size (length) by the two age classes also varied, with juveniles taking about 80% of their seeds in the 4.1 to 4.5 mm size class. Of the adult diet, 84% was composed of seeds less than 3.5 mm in length. This difference in seed size for juveniles and adults apparently resulted from the heavy use by juveniles and light use by adults of a single seed type, sunflower (*Helianthus annuus*), which was approximately 4.2 mm in length. Although sunflower seeds were equally available, to both age classes, they were not the preferred food of adults.

TR137 Bauerle, B. and D. L. Spencer. 1971. Environmental pollutants in two species of snakes from the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 137. Colorado State Univ., Fort Collins. 15 p.

Pawnee, Snake

Food chain magnification of environmental pollutants would suggest that a nonmigratory, locally occurring, higher order consumer such as the snake, may prove to be a valuable pollution indicator on the shortgrass prairie. Fat bodies were removed from two male gopher snakes, (*Pituophis catenifer*), and two male prairie rattlesnakes, (*Crotalus viridis*), collected near the Pawnee Site during July 1971. Adipose tissue was analyzed by the Colorado State Department of Health Pesticide Laboratory, Greeley, Colorado, for the presence of 36 different herbicides, pesticides, and organophosphate fertilizers by using electron capture gas chromatographic methods. Samples were also analyzed for PCB's (poly-chlorinated bipherals) and sulfur compounds. Results show that the snakes sampled, which are secondary consumers feeding on small mammals, have low levels of environmental pollutants in their adipose tissues. Gopher snakes were found to contain .20 ppm of p,p'-DDE, .04 ppm of dieldrin, .013 ppm beta benzene hexachloride, and .01 ppm heptachlor epoxide. Prairie rattlesnakes contained .62 ppm p,p'-DDE and .03 ppm dieldrin. Data indicated that further anlaysis by flame photometric methods was unnecessary. Low levels found in snakes sampled would seem to correlate with agricultural practices on the Pawnee National Grasslands. Artificial fertilization and pesticide spraying are seldom used in this area.

TR138 Gustafson, J. D. and G. Innis. 1972. SIMCOMP version 2.0 user's manual. U.S. IBP Grassland Biome Tech. Rep. No. 138. Colorado State Univ., Fort Collins. 62 p.

Computer programs, Models, Modelling concept, Simulation

SIMCOMP is a computer programming system which is designed to aid biologists with a limited knowledge of FORTRAN programming to design and execute compartmental-flow simulations. The system is designed to minimize the programming overhead required by any computer language while maintaining sufficient flexibility to solve most problems. A simulation is defined by specifying the flow rates between compartments and may be in either difference of differential equation form. Tabular and graphical output may be requested. The design and mathematical formulation of a simulation is described. The syntactical rules for writing SIMCOMP programs and the solution technique is explained.

SS02,3-26 Van Dyne, G. M. 1969. Some mathematical models of grassland ecosystems, p. 3-26. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Models, Producer model, Modelling concept, Succession

A diagrammatic representation of an ecosystem is outlined and a mathematical notation showing interrelationships of components is presented. The mathematical notation is developed step-by-step to build a compartment model. General differential equations describe quantitatively the simultaneous transfer of materials or energy among interrelated components within this theoretical model. Analog, digital, and hybrid analog-digital computers make possible the solution of realistically complex models necessary for accurate descriptions of biological systems. Two studies, one dealing with intraseasonal vegetation change (herbage dynamics) and one with interseasonal change (secondary succession on old fields), illustrate applications of models. Some cautions and considerations about modelling are: (1) Successive revisions of a model are essential in order to approach a realistic simulation, and no model is perfect; (2) A model that approximates a system fairly accurately provides not merely a graphic representation, but, more importantly, a predictive instrument for manipulating a system and describing changes under natural and artificial stress; and (3) Development of realistic mathematical models of grassland ecosystems will not be trivial and will not be done by a single man, but, rather, they will be a product of team effort requiring constant feedback and communication among investigators in the field, the laboratory, and the armchair.

SS02,29-39 Collins, D. D. 1969. Macroclimate and the grassland ecosystem, p. 29-39. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Climate, Precipitation, Air temperature

Vegetational distribution in the Great Plains is primarily determined by macroclimatic factors. Of the various climatic factors involved, the amount and seasonal distribution of moisture are the major determinating factors. The north-south orientation of high-mountain coastal ranges in North America effectively restricts the movements of maritime air inland past the Continental Divide. At the same time, the lack of east-west topographic barriers allows for free mixing of the warm, humid Gulf air mass and the cold polar air mass of the Arctic, making the Great Plains a major region of cyclogenesis and strong cyclone activity. Differences in seasonal patterns and total amounts of precipitation are directly related to the patterns of wind-flow for the three major air streams in the Great Plains. The widespread droughts which occur infrequently in the summer result from a replacement of the moist maritime Gulf flow by the dry continental westerlies.

SS02,40-64 Whitman, W. C. 1969. Microclimate and its importance in grassland ecosystems, p. 40-64. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Microclimate, Soil temperature, Wind, Evaporation, Atmospheric water, Soil water, Energy balance

Microclimate investigations have been concerned with the prevailing atmospheric conditions within the plant canopy and immediately above the canopy. These are the conditions determining the effective climate within which the grassland plants go through their diurnal, seasonal, and life cycles. The most obvious feature of the microclimate above a grass sod is the gradient in environmental factors which exists at nearly all times. The nature of the gradients in temperature, wind movement, atmospheric moisture, and evaporation above mixed-grass prairie has been found to result in a generally more rigorous climatic situation close to the surface of the earth than that which exists above the vegetation canopy.

Soil moisture perhaps cannot be considered as a microclimate factor, but its overwhelming importance in the functioning of the grassland ecosystem makes consideration of this factor essential in any discussion of microclimatic influences. High atmospheric evaporative potential and shortage of soil moisture are characteristic features of the microenvironment of the mixed-grass prairie. The direct influence of these features on plant activities is just beginning to come under intensive analytical study, especially in the field of water stress.

Energy balance studies in the grassland microenvironment have been few in number, but the development of precise mathematical formulations of plant-energy environment relations, so essential to successful grassland ecosystem modeling, is dependent on the acquisition of information from such studies. The work which has been done provides guidelines and examples for the development of precise expressions of such relations, but the qualifying conditions of the microclimate under which these expressions will have validity in the grassland ecosystem remain to be worked out.

SS02,65-70 Terwilliger, C. Jr. 1969. Physical properties of grassland soils and their influence on primary productivity, p. 65-70. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Soil physical characteristics, Soil aeration, Soil water, Infiltration, Moisture stress, Soil temperature

The size, shape and arrangement of soil particles influence primary productivity through their individual and interacting effects on soil aeration, soil water, soil temperature and soil-plant-nutrient relationships.

The chemical environment in which roots and microorganisms live depends upon the exchange of gas between atmospheric air and soil air. Diffusion accounts for the largest proportion of this gas exchange. Total soil porosity and moisture content are the most important soil characteristics influencing diffusion rates. Growth of dry grassland plants is reduced by poor aeration. This reduced growth may be due to: (1) reduced water uptake, (2) reduced nutrient uptake, and (3) the toxic effect of excessive carbon dioxide.

Interaction between soil physical properties and climate determine the moisture regime of a particular system. In a dry grassland system where moisture is received during the growing season, sandy soils are more mesic than heavier soils. This effect is due to the relative importance of water-holding capacity, infiltration and evaporation.

Increasing moisture stress reduces rate of plant growth, but a modest reduction in growth rate may favor sugar and starch accumulation in plants and thus favorably effect the primary consumer.

Soil temperature is important in controlling the physiological processes of the plant and the activity of the soil microorganisms. Soil temperature depends upon the amount of radiation received, the amount absorbed, the heat capacity of the soil, and its conductivity. The last three factors are dependent upon soil physical properties.

Cation exchange capacity is influenced greatly by soil texture. This characteristic is very important in determining the retention of nutrients by the soil, the chemical characteristics of the soil solution, and the uptake of nutrients by the plant.

SS02,71-88 Kline, J. R. 1969. Soil chemistry as a factor in the function of grassland ecosystems, p. 71-88. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Soil chemical characteristics, Fire, Plant nutrients

This review is confined to the subject of the role of mineral nutrition in the functions of grassland ecosystems. Results from the literature are chosen selectively rather than exhaustively to permit a qualitative overview of the subject which is not overburdened with excessive detail. The subject matter is further restricted by considering only dominant processes in their main effects and ignoring complex interactions as far as possible. A plan is followed which attempts to bring together some of what is known about soil chemistry and some of what is known about plant responses and functions in order to make at least an approach to understanding what role mineral nutrients and soil chemical properties have in determining properties of plant communities.

The soil is the ultimate reservoir of plant nutrients, while plants through the expenditure of metabolic energy are a driving force for nutrient release and uptake from soils. How this affects plant community structure and function is obscured by several factors. First, since all plants require the same group of nutrients it is not immediately clear how they influence differentiation in plant communities. Second, plant communities are affected in their structure and function by a host of other variables which, except in extreme conditions, may dominant the community response and obscure the role of nutrients. Such variables are well known and include grazing, moisture regime, insects and others.

Although plants require qualitatively the same group of nutrient elements for survival, evidence is presented that they are themselves differentiated with regard to their ability to extract and utilize nutrients even from the same substrate.

Several examples of this differentiation are discussed along with examples of how this is manifest both in productivity and species composition of vegetation. It is often possible to correlate the properties of a plant system with those which are easily observable in soils such as profile characteristics while it is just as often found that quantitative measurements of soils are not well correlated with plant community properties. This may be due in part to the presence of unmeasured influences such as those previously mentioned which have important effects on plant communities. Evidence is presented which indicates that the influence of nutrients in plant communities may be assessed better through experimental application of nutrients to the soil than through the correlative approach because of the presence of these variables.

SS02,89-100 Pochop, L. O. 1969. Dynamics of the atmosphere in the grassland ecosystem, p. 89-100. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Precipitation, Air temperature, Energy balance

Methods of describing the variability of meteorological events have been discussed and a number of approaches which may have application to the grasslands are cited. In addition, the importance of meteorological parameters to the energy budget has been considered. Evaluation of the energy balance is described in terms of these parameters.

SS02,101-116 Striffler, W. D. 1969. The grassland hydrologic cycle, p. 101-116. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Hydrology, Water cycle, Hydrological cycle, Precipitation, Interception, Infiltration, Evapotranspiration, Erosion, Runoff

Of the many factors which contribute to the physical environment of the grassland ecosystem, the movement of water into, through, and eventually out of the system is without doubt a major stimulus in the functioning of the system. This movement or cycling of water in the ecosystem essentially consists of precipitation inputs, runoff outputs, and a series of intermediate process influencing the magnitude of the precipitation/runoff relationship. These include interception, infiltration, percolation, evapotranspiration, surface runoff and storage at various levels of the system.

Hydrologic investigations in grassland environments reveal some of the characteristics of the various processes. Precipitation in the shortgrass prairie type generally ranges from 250 to 500 millimeters, with less than 10 percent occurring during the winter months and May and June receiving 30 to 50 percent of the annual rainfall. Summer storms are freqeuntly intense thunderstorms with small areal distribution. Rainfall interception of storage capacity on grassland vegetation may range from .50 to 5.0 millimeters depending on the density of the vegetation and stage of growth. Litter interception has been measured between .20 and 1.50 millimeters depending on the amount. Infiltration rates on rangelands depend on soil characteristics, topography, season, and vegetation or grazing pressure. Measured rates vary from essentially zero to as high as 125 millimeters per hour. Evapotranspiration losses depend primarily on the evaporative potential of the environment and the availability of water. Measured daily maximum rates ranged from 1.5 to 2.0 millimeters per day. Seasonal consumptive use generally amounts to about 90 percent of annual precipitation. Runoff from grasslands is very low, averaging about 25 millimeters for the Great Plains. Although highly variable, small watersheds may have greater yields than large watersheds due to the limited distribution of rainfall events and channel transmission losses.

SS02,117-123 Burzlaff, D. F. 1969. The role of the abiotic factors in the structure and function of the grassland ecosystem, p. 117-123. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Climate, Microclimate, Fire, Soil physical characteristics, Soil chemical characteristics

The biota of the grassland ecosystem functions through broad fluctuations in each abiotic component of the environment. Such ecosystems are analyzed through a study of various abiotic components and an assessment of biotic response to changes of one or more of these environmental variants. Many of these limits are well documented. The major voids of understanding exist in the very complex interrelationships of the abiotic components and the subsequent impact on the biota. Thus, comprehension of grassland ecosystems will involve complex models of which the abiotic factors are integral components. Simple correlations are not likely to yield additional insight into the structural and functional aspect of grasslands. Investigators pursuing such objectives must select those factors upon which soil and vegetation are most dependent, since it is impossible to study all environmental entities in detail. The nature of interrelationships must be established and interpreted. Studies relative to biota--soil moisture relationships will prove to be most useful in developing the functional and structural aspects of grassland ecosystems. This will involve both chemical and physical characterization of the soils. In the study of net energy balance, standard meteorological data must be supplemented with measurement of net solar radiation. Detailed documentation of evapotranspiration losses must be obtained. The most relevant information concerning soil moisture disappearance will be achieved through techniques in precision lysimetry. Complete understanding of soil biodynamics requires measurement of oxidation-reduction levels and gas composition and exchange within the soil atmosphere.

SS02,125-147 Moir, W. H. 1969. Energy fixation and the role of primary producers in energy flux of grassland ecosystems, p. 125-147. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Net radiation, Heat transfer, Photosynthesis, Efficiency energy capture, Moisture stress, Growth analysis, Plant growth

This paper reviews how herb-dominated communities, grasslands in particular, bring about energy transformations. In a nonbiological, purely physical land system solar energy incident to a land surface is subject to transformations of sensible and latent heat flux and thermal radiation emission. In a grassland ecosystem upward of 2-3%, more or less, of incident solar energy is channeled into chemical energy as a consequence of metabolic activities of plants. Photon trapping by chlorophyll is the first step in energy fixation, and numerous subsequent chains of enzyme reactions lead to chemical energy stored as plant biomass. During these processes of chemical transformation, a grassland community brings about modifications in other energy flux components of the land surface.

The central thesis of this review is that the energy transformations within the grassland ecosystem must be very closely regulated by abiotic and synecological environmental factors. Photosynthesis of leaf mesophyll is sensitive to ambient changes in the leaf microclimate. Plant growth depends upon a supply of photosynthate and upon seasonal changes in the whole-plant environment, which in turn affect metabolic systems regulating plant ontogeny. Despite the seeming remoteness between solar energy and the energy of chemical storage in plant tissue, as given in Fig. 1 of the text, the integration of instantaneous physiological and microenvironmental events over an entire growing season is a very real plant function that can be expressed by changes in community biomass over the growing season.

SS02,148-152 Ward, R. T. 1969. The nature and significance of eco-genetic variation in ecosystems, p. 148-152. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Ecotype, Anthesis, Plant respiration, Respiration

The importance of genetically fixed eco-physiologic variability within species has been recognized since the early work of Turesson. Much of the research in this country has been concerned with dominant grasses of the central grassland of North America. Broad climatic patterns of phenologic and morphologic ecotypic variability have been demonstrated for most of the species studied. Northern populations, in contrast to those of the south, are earlier in development and shorter in stature. Ecotypes in relation to edaphic and biotic factors have also been demonstrated. Studies of the physiological attributes of ecotypes have indicated differences but little consistent patterning. It is evident to extend the information and hypotheses drawn from a few study sites to the broad landscape of the grasslands will require a thorough knowledge of intra-specific, genetically-fixed physiological-ecological variation in the component species.

SS02,153-171 Risser, P. G. 1969. Competitive relationships among herbaceous plants and their influences on the ecosystem function in grasslands, p. 153-171. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Plant competition

Competition among organisms may be defined as the simultaneous demands for the same resources in a common environment when these demands are in excess of the immediate supply. The resources for which competition may occur among plants are water, nutrients, light, oxygen, carbon dioxide, and during the reproduction phase, agents of pollination and dispersal. Mathematical models developed from both theoretical and experimental populations of pure and mixed species are examined in terms of the conditions for which they are valid and for the expansions which will be necessary for application to field conditions. The fragmented information now available can be united into a general model. This review of previous investigations indicates that if the seed size and number, time of germination, rate of vegetative production, rate of growth, maximum number and size of individuals attained under optimum conditions, soil level at which roots operate, time and conditions for initiation of root and shoot growth, and any allelopathic considerations are known for any given species, a reasonably good prediction can be made concerning the success of that species relative to any other for which the same information is known. The competitive relationships for a community can then be represented by a species-by-species matrix in which the elements would represent nonlinear coefficients by which the total productivity would be differentially partitioned among species under the constraints imposed by moisture, nutrients, grazing, etc.

SS02,172-182 Shubert, M. L. 1969. The nature and importance of competition between woody and herbaceous plants in a grassland ecosystem, p. 172-182. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Plant competition, Grazing influence, Fire

The intensity of competitive interaction between woody and herbaceous plants is conditioned by these factors: Inherent qualities of the competing individuals, the abiotic environment, other kinds of interaction with plants and animals which affect the vigor of the competing individuals, catastrophic events such as fire, and man's activities. Literature is reviewed to illustrate these factors and to provide information as to the importance of this type of competition in a grassland ecosystem.

SS02,183-196 Fisser, H. G. 1969. Plant pattern and distribution in ecosystems and relationships to function, p. 183-196. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Plant pattern

Historically, distributional aspects of vegetation on a multitude of levels were evaluated on a subjective basis, with little emphasis given to factors responsible for observed characteristics of location or functions inducing variations in dispersal. The contention for the analysis of pattern lies with the implication that the distribution of the organisms may be utilized to evaluate the forces responsible for non-random dispersion. Pattern thus becomes a legitimate object of ecological investigation if used to determine causitive factors in plant distribution, or as an aid in the establishment of tolerance ranges.

Quantitative analyses of intracommunal distributional characteristics emphasized that random distribution was the exception rather than the rule. The form of vegetation pattern can be related to two general classes of nonrandomness: contagious and regular. In most cases analyses of distribution properties have shown that contagious distributions are the most common.

The term pattern may imply repeatability, but it does not necessarily imply uniform repeatability, since the factors causing non-random plant dispersions need not repeat themselves uniformly over geographic space. The evaluation of vegetation distributional form must be conducted in light of the kinds of possible causative factors and their form of pattern as related to the configuration of plant dispersal.

For the detection of non-randomness by application of mathematical expectations, early workers utilized the Poisson and binomial distributions with a great number of modifications. Analysis for association has been conducted to determine the existence of similar biological groups and the ecological amplitude to environmental forcing functions. Common analytical procedures for association testing are the contingency and correlation analyses. A rather new and promising development in the description and analysis of organism dispersion criteria has been the use of multivariate analysis. By integration of many forms of quantitative data, the derived ecologically meaningful groups lead to a technique for determination of pattern causality, more sensitive than earlier procedures. Studies to evaluate patterns and their causal relations seem doomed to failure if not incorporated into an integrated systems analysis approach.

SS02,197-220 Knight, D. H. 1969. Some influences of vegetation structure on energy flux, water flux, and nutrient flux in grassland ecosystems, p. 197-220. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Vegetation structure, Leaf area, Plant cover, Leaf area index, Photosynthesis, Net photosynthesis, Interception, Soil temperature, Evaporation, Reflectivity, Species diversity

This paper synthesizes the information now available on how vegetation structure may influence energy flux, water flux, and nutrient flux in grassland ecosystems. The discussion is focused on the influence of leaf area, leaf angle, vegetative cover, growth-form composition, and diversity. Such features have been shown to be modifiers of light penetration, evaporation from soil, infiltration, run-off, wind velocity, raindrop impact, and other aspects of energy flow. Data are presented that suggest the magnitude of flux modification by some features. The influence of vegetation structure on nutrient flux, and the influence of diversity, do not appear to be well understood, but some ideas are included which may be pertinent. Brief consideration is given to the measurement of vegetation structure and to the influence of structure on animal populations and diversity.

SS02,221-224 Bement, R. E. 1969. Dynamics of standing dead vegetation on the shortgrass plains, p. 221-224. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Standing dead

The aboveground plant biomass on the shortgrass plains fluctuates widely, both intra-seasonally and inter-seasonally. Intra-seasonal fluctuation is characterized by the on and off growth pattern of grama grass. The transfer rate from live plant tissue to standing dead vegetation accelerates after each spurt of growth. Two methods for measuring the rate of transfer from live plant tissue to standing dead vegetation are considered.

SS02,225-240 Tomanek, G. W. 1969. Dynamics of mulch layer in grassland ecosystems, p. 225-240. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Litter, Infiltration, Erosion, Litter decomposition, Decomposition litter

Numerous studies were reviewed which included some measurement of the amounts and effects of mulch in the grassland ecosystem. Mulch increases soil moisture through its effects on infiltration, evaporation and run-off. It stabilizes soil moisture and soil temperature, which improves conditions for germination; and often the presence of mulch alters the botanical composition. All of these effects influence the amount of green herbage produced which eventually replenishes the mulch. Factors affecting the amount of mulch in the grassland ecosystem include soils, topography, grazing, rainfall, temperature, mowing, and fire. Mulch does play a vital role in the grassland ecosystem in its effects on the environment and organisms that inhabit the environment.

SS02,243-260 Hyder, D. N. 1969. The impact of domestic animals on the function and structure of grassland ecosystems, p. 243-260. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Shortgrass, Pawnee, Air temperature, Precipitation, Plant checklist, Soil temperature, Plant growth, Yield, Blue grama, Nitrogen, Steers, Stocking rate, Mammals, Cattle, Ingestion, Cattle biomass, Mammal biomass, Compaction, Growth rate

The grassland at the Central Plains Experimental Range (Pawnee Site) is described as shortgrass plains due to climatic conditions. This grassland is unique because grazing by livestock has only slight effects on species composition, even though excessive stocking rates reduce herbage and beef production. Herbage production is reported to amount to about 670 kg/ha annually, but total herbage production has not been accounted for except possibly in the work of Turner and Klipple (1952). Blue grama, the dominant species, grows by spurts when soil moisture is available for growth in the warm season. The impact of grazing on herbage production is a function of the frequency and duration of the spurts of growth as well as of the stocking rate. At a moderate stocking rate of 1.05 ha per yearling-month in the warm season (May through October), the demand for forage amounts to about 1.1 kg/ha/day; whereas the herbage growth rate may exceed 20 kg/ha/day for short periods. Maximum daily intake of forage by yearlings is attained when the standing crop amounts to about 340 kg/ha of dry matter. Thus, the annual demand for forage (about 200 kg/ha) requires a production of at least 540 kg/ha of herbage. Forage intake by cattle probably accounts for less than 1/4 of primary production. The energy content of the forage consumed is returned to the soil (about 43%), dissipated to the air (about 48%), and retained in animal gain (9%). About 2 or 3% of the energy fixed in primary production of herbage, therefore, is retained in animal gain.

SS02,261-267 Everson, A. C. 1969. Replacement of native plant communities with introduced communities and its impact on ecosystem function, p. 261-267. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Community replacement, Succession, Primary production

Native plant communities have been replaced with introduced plant communities throughout the history of man. The primary objective of the replacement has been to supply a greater quantity, quality, and variety of foodstuffs for human and domestic livestock consumption. Sometimes the community replacement has been gainful; sometimes it has not been successful. Results of the replacements, until recent years, have usually been measured only in yield of human food products or forage per unit of area. Within the last two decades the role of all biotic populations and all abiotic factors within the complex ecosystem, and the impact of community replacement on function of the ecosystem, have received attention. After community replacement the original abiotic factors assume different dimensions. The biotic populations are subjected to a new environment, and there is a dynamic response. Respective biotic populations may decrease or increase. The ultimate objective of replacing native plant communities with introduced communities is to make the most efficient use of solar energy and maximum use of all climatic and edaphic characteristics.

SS02,268-278 Gross, J. E. 1969. The role of small herbivorous mammals in the functioning of the grassland ecosystem, p. 268-278. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Mammals, Mammal density, Jackrabbit, Jackrabbit density, Cottontail, Pocket gopher, Ground squirrel, Deer mice, Cottontail density, Pocket gopher density, Ground squirrel density, Deer mice density, Rodent, Rodent density, Food composition

Small herbivorous mammals (rodents, hares, and rabbits) undoubtedly exert appreciable influences on the functioning of the grasslands ecosystem. A model of these influences and functions is a necessary component for the grassland ecosystem macro-model. However, despite considerable research on the impact of small herbivorous mammals on their habitat, the nature and extent of many discernible plant-animal ecological interactions have been clouded by narrow research orientation, study-period limitations, and faulty experimental design.

The actions of small herbivorous mammals on their habitats may be divided, according to the literature, into three broad categories. Vegetative interactions include: (1) range composition, range condition, and succession; (2) plant consumption and wastage; and (3) animal dietary composition. Soil interactions include: (1) structure, (2) altered vegetation structure; (3) water infiltration; and (4) flow and cycling of nutrients and minerals, respectively. Animal interactions include: (1) livestock consumption equivalents; and (2) interspecific cohabitation and exclusion.

Many early ecologists (ca. 1930) concluded that the small herbivorous mammals were universally responsible for range deterioration, and were also responsible for inhibited succession, accelerated succession, and altered plant speciation. Recent investigators recognize the small herbivores may be either a cause or a symptom of all the foregoing conditions.

The nature and extent of the small herbivorous mammal's impact on range vegetation depend in part on associated influences of domestic livestock, geographic location and weather, particularly the former. Although food consumption by small herbivorous mammals is frequently converted to domestic livestock equivalents, the results are confounded by complex seasonal intraspecific changes in diets and by divergent interspecific diets.

The impact of small herbivorous mammals on soil was viewed by early investigators as hopelessly complex and beyond precise description. The bulk of quantified information on animal-soil interactions is on soil-movement resulting from burrowing. Likewise, only limited qualitative information is available on inter-specific cohabitation and exclusion.

The lack of conceptual mechanisms describing interaction of plants on animals necessitates reforming the modelling approach to one of delineating the impact of plants on the animals.

SS02,279-289 Glover, F. A. 1969. Birds in grassland ecosystems, p. 279-289. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Birds, Pawnee, Bird checklist, Bird energetics

Birds are important in the ecology of grasslands because of their roles in the food web and flow of energy. A wide variety of birds serve as primary, secondary, and mixed consumers in the grassland biome. The ecology of birds in grasslands is an area in need of serious research. The major areas of research should be concerned with mobility of birds, biomass variations, and interrelationships with abiotic and biotic factors.

SS02,290-299 Blocker, H. D. 1969. The impact of insects as herbivores in grassland ecosystems, p. 290-299. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Insects, Grasshopper, Insect population

Grasshoppers are the only insect group which is presently known well enough to evaluate in detail their impact upon grasslands. Life-system studies on major species are also desirable. Little is known concerning leafhoppers as herbivores. A population census is needed before it can be determined which species of leafhoppers as well as other insect herbivores warrant concentrated ecological study in the grasslands biome. The effect of parasites, predators and diseases on herbivores should also be considered. The major literature pertaining to methodology of ecological research has been surveyed. It is evident, however, that existing methods need to be adapted to suit the grassland environment, and new supplementary methods must be found. Various methods of population sampling and damage evaluation are discussed briefly.

SS02,300-306 Post, G. 1969. The role of diseases and parasites in a grassland ecosystem, p. 300-306. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Diseases, Parasites

All animals on this earth have parasites which are closely involved in their lives. Therefore, no study of a population of animals is complete without careful evaluation of the effect of parasites on each host. Parasitic life cycles have evolved which make the study of parasitism in an ecosystem, such as a grassland, very difficult.

Vertebrate hosts of a grassland ecosystem have, for the most part, been able to survive in spite of periodic losses to disease. As these vertebrate populations reach high numbers, transmission of parasites is usually increased because of the distance between hosts. Parasite numbers on or in a host may increase at times to the point where they may overwhelm the host. The final effect is reduction of host populations to the level where parasitic transmission is no longer easy. Many times the parasite does not actually cause mortality among hosts but is a carrier of pathogens which do cause the loss. Vector populations usually increase at times of high host populations.

The experience of animals coming into contact with pathogenic parasites usually limits complete mortality within a population because of the immune response among the survivors. This immune response is a protective mechanism which makes possible the survival of any of the grassland vertebrates. Some hosts have a natural immunity to pathogens. Therefore, host resistance (either natural or acquired) must be considered in any study of animal populations.

Very little is known of the number or species of parasites living in or on the vertebrate hosts within the Pawnee Grasslands study site. However, the assumption is made that each possible host will have its complement of parasites. These parasites must be supported by the energy flow pattern within the ecosystem. Most authors agree that the energy required for growth, survival and reproduction of parasitic organisms is small. Larger numbers of parasites may collectively require considerable amounts of energy. There are a few methods of measuring the required energy if certain parts of a life cycle of the parasite are studied. Very few of the parasites of grassland vertebrates will be acceptable for in vitro study of the entire life cycle. The clinically detrimental effect of each of the pathogenic, or potentially pathogenic, parasites can be assessed with some degree of accuracy. Subclinical effects are more difficult to determine.

Research to identify and to enumerate the parasites on a chosen number of vertebrate species in the Grassland Biome is needed. When such data are accumulated, and applied to general biological data recorded for each host, the effects of parasitism may be obvious.

SS02,308-315 Lavelle, J. W., J. A. Seilheimer, N. L. Osborn, and S. J. Herrmann. 1969. A preliminary study of three lentic communities on the Pawnee National Grasslands, p. 308-315. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Ponds, Pond physical characteristics, Pond chemical characteristics, Phytoplankton checklist, Zooplankton checklist

Literature was reviewed on primary productivity of grassland lentic communities. Studies of this nature are very limited in number and apparently lacking for the Colorado, Wyoming, and Nebraska area. Instrumentation was developed to measure and record diurnal oxygen changes in grassland ponds. Three shallow water bodies on the Pawnee Grasslands were surveyed: Cottonwood Pond, Spring Pond, and Lake George. The surface areas were 0.4, 0.3, and 20.2 hectares respectively. All three ponds had a mean depth of approximately .5 meters. Biological and chemical sampling was done at monthly intervals on each pond beginning in September, 1968. This preliminary survey showed each pond to be highly unique in its chemical and biological characteristics. The three ponds, however, represent types which occur commonly in the grassland biome.

SS02,316-329 Pieper, R. D. 1969. The role of consumers in a grassland ecosystem, p. 316-329. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Energy flow, Sheep, Ingestion, Cattle, Mammals

Grassland consumers are a heterogeneous group representing many species of organisms. They can be classified as herbivores, omnivores and carnivores. A portion of the total amount of energy available to herbivores is unused and passes directly to decomposer food chains. Of the total amount of energy consumed by the herbivores, part is voided in feces and urine, part goes to decomposer food chains from herbivores succumbing to mortality factors, part is dissipated as heat through formation of gases and utilized as heat increment and heat of maintenance, part passes to carnivores -- and only a small part is used for production. Ecological efficiencies have been calculated for different trophic levels in aquatic ecosystem but few for terrestrial ecosystems.

Grassland consumers alter distribution patterns of chemical elements through desposition of urine and feces. This may act as a fertilizing influence, but some chemical elements are transferred through food chains.

SS02,331-360 Paris, O. H. 1969. The function of soil fauna in grassland ecosystems, p. 331-360. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Soil fauna, Decomposition plant, Decomposition. Earthworms, Mollusks, Isopods, Diplopods, Insects, Decomposer energetics, Soil fauna population, Reducers, Collembolans, Enchytraeids, Mite, Ant, Microbial population, Nematodes, Microbial energetics, Microflora, Predation

The functional role of soil fauna in grassland ecosystems can be summarized by means of a flow chart which depicts the major pathways of energy flow and nutrient transfer between various trophic categories. It is convenient to view the grassland food web as consisting of two interlocking webs, a grazing food web and a detritus food web. The grazing food web is powered by the input of solar energy into the primary producers (vegetation). The detritus food web is powered by energy derived from the grazing food web in the form of dead plant and animal material, feces, etc.

Saprophagous primary decomposers play the same role, to a degree, as do bacteria and fungi. That is, they effect primary decomposition of dead plant and animal matter, thus dissipating energy and returning nutrient elements to the soil. Saprovores also channel energy and nutrients from the detritus food web back into the grazing food web, by serving as a food resource for carnivores. Microfloral grazers may serve to recirculate energy and nutrients in grasslands, both within the detritus food web and by transferring material back to the grazing food web.

The importance of soil fauna in hastening the decomposition of dead organic matter is firmly established. Without this group of organisms to comminute detritus and to scavenge on carrion and feces, the process of decomposition would be slowed. As a result, organic material would accumulate, successional changes might occur, and primary production would probably be reduced because of a decrease in the rate of nutrient cycling.

The soil fauna must contribute significantly to the stability of the grazing food web, by virtue of the fact that they provide additional trophic links for input of energy and nutrients into the secondary and higher trophic levels. By thus providing an alternative energy resource for carnivores, fluctuations in herbivore availability are buffered. Populations of saprovores and microbivores typically fluctuate in abundance, both seasonally and often from year to year.

The xeric conditions that characterize the shortgrass prairie at the Pawnee Site result in an absence of several groups of decomposing reducers which are important in other grasslands. Consequently, insects, because of their ability to withstand dessication, probably assume a greater importance in prairie grasslands than in many other grasslands. For these and any other soil organisms which prove to be abundant, the parameters which should be investigated include the following important ones: life cycle, population abundance and distribution, population fluctuations, annual replacement rate, food resource and feeding rate, efficiency with which ingested food is assimilated, energy requirements for maintenance and production, and influence of abiotic and biotic factors on abundance and distribution.

SS02,361-376 Clark, F. E. 1969. The microflora of grassland soils and some microbial influences on ecosystem functions, p. 361-376. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Microbial biomass, Bacteria, Bacteria population, Actinomycetes, Fungi, Algae, Lichens, Exudate, Decomposition, Decomposition standing dead, Decomposition litter, Litter decomposition, Decomposition soil organic material, Nitrification, Microflora

The soil microflora is the single most important group in the annual turnover of the energy trapped by photosynthesis. The component groups of the microflora are the bacteria, actinomycetes, fungi and algae. Biomass values for these groups taken in conjunction with metabolism calculations suggest that the great majority of the microorganisms present in soil are dormant or inactive at any given time. Even so, in the course of their periods of intense activity they have tremendous influence on diverse biotic and abiotic components of the grassland ecosystem. Species composition of grassland microfloras, the role of the soil microflora as decomposer organisms, and their participation in those portions of the grassland carbon cycle dealing with the decomposition of plant residues and the formation of soil organic matter are discussed.

SS02,377-402 Porter, L. K. 1969. Nitrogen in grassland ecosystems, p. 377-402. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Nitrogen, Soil nitrogen, Nitrification, Mineralization, Nitrogen turnover

Grasses and grain crops in the Great Plains usually respond to both water and available nitrogen. Rarely is the supply of these resources sufficient for maximum productivity, and there is a strong interaction between these two resources in their effect on productivity. Only small amounts of nitrogen become available each year from the vast reservoir of organic nitrogen in Great Plains soils. Tilling the native grassland soils has caused marked declines in their nitrogen content. The effect of the environment on the nitrogen content of grassland soils is discussed. In order for man to manage judiciously the vast nitrogen reserves in grasslands he must more fully understand the transformation of nitrogen in such soils and the turnover of fertilizer nitrogen in soils and plants. Natural nitrogen inputs into grassland soils are not clearly defined; especially lacking is the contribution that native legumes make. Also, investigations are needed to clarify the magnitude of nitrogen losses from grassland soils. Such loss information will become highly important as man increases his use of commercial nitrogen fertilizers in order to maximize productivity and effectively use stored water. Fertilizer nitrogen could be another possible pollutant to our water resources. In order to avoid any pollution, it is imperative that we understand the fate and movement of fertilizer nitrogen in grassland ecosystems.

SS02,403-409 Alexander, M. 1969. Soil decomposers, p. 403-409. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Decomposer ecology

Despite the extensive literature on soil decomposers, there exists a dearth of significant findings relative to the participation of these organisms in grassland function. Consideration is given to the necessity and importance of research dealing with further description of decomposer species in grassland soils, studies of interactions within the decomposer community and investigations of the interplay between the decomposers and their surroundings. Some problems in investigations of decomposer ecology and function are raised, and possible avenues of approach are suggested. The characterization of the dominant species, the nature of the microbiological climax, biogeographic problems, dispersal of microbial propagules, the course and causes of succession, the phyllosphere and root-decomposer associations are briefly reviewed. The interspecific interactions and causes of these relationships are examined, and attention is given to the biochemical influence of the decomposer community on its subterranean ecosystem.

SS02,410-437 Bledsoe, L. J., and D. A. Jameson. 1969. Model structure for a grassland ecosystem, p. 410-437. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Models, Ecosystem model, Modelling concept

This report relates the methods used by the personnel of the Grassland Biome Program for the initiation of development of a whole ecosystem mathematical model. The form of that model, as it stands before computational or field testing, is set forth. A section, intended in part to be read by the non-mathematically inclined scientist, is devoted to the explanation of notation and mathematical conventions. The abiotic variables are divided into extrinsic or driving variables and intrinsic variables such as environmental temperatures and soil moisture which are mathematically related to the driving variables. A relation of photosynthesis to sunlight, temperature and soil moisture and nutrients is derived on the basis of information in the literature. A series of equations summarizing inputs and losses from the primary producer compartment are presented. A general form for consumer population dynamics in terms of a continuously variable age structure is used. Individual animal weights are calculated on the basis of estimated food intake and respiration functions. Members of the detritus food chain are treated in a functional manner and only nitrogen cyclers are mentioned as an example. Finally the close interaction of the four sections is illustrated with three examples of mathematical connections between trophic level variables.

SS02S241,1-87 Lewis, J. K. 1970. Primary producers in grassland ecosystems, p. 1-87. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. *A supplement*. Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Succession, Vegetation structure, Aboveground plant biomass, Belowground plant biomass, Plant pattern, Energy flow, Plant energetics, Photosynthesis, Plant respiration, Plant nutrition, Grazing influence, Primary production, Respiration

The grassland vegetation of today is the result of the controlling factors of the elements of climate, geological materials (including parent material, relief and ground water), and available organisms (both macro- and microflora and fauna) interacting through time. The vegetation, as we see it today, is the result of autogenic progression, allogenic succession (probably both regression and progression), succession induced by the activities of man, change due to fluctuation in the controlling factors of the ecosystem or to dynamic adjustments among the dependent factors (vegetation, microclimate, reducers and decomposers, consumer organisms and soil). Cyclical changes may also be involved.

These kinds of ecosystem changes result in vegetation structure which can be observed and measured. The structure can be categorized by (i) life form; (ii) the species composition and infraspecific variation; (iii) the morphology of the plant community, including leaf area index and characteristics of the plant biomass; (iv) the microclimate within the vegetation; (v) the organisms which are closely associated with or attached to the vegetation; (vi) the vegetation pattern (morphological, sociological and environmental); (vii) periodicity; (viii) stratification; and (ix) species diversity. Vegetation structure is determined by the interaction of competing plant taxa with the environmental complex.

Ecosystem function includes energy flow, nutrient cycling and ecosystem regulation. Vegetation is involved in each of these functions, and their parameters are influenced by the vegetation structure. Net primary production, which is the contribution of the vegetation to energy flow, is the result of vegetation structure and the constellation of factors that affect the light, temperature, moisture, mineral nutrition, and other chemical activities of the competing plant taxa. Net primary production is thus strongly conditioned, not only by the climate and soil, but also by the extensive interlocking activities of the great variety of organisms involved in the grazing and the detritus food web. The management activities and mismanagement activities of man may be overriding in their effects. Methods of measuring net primary production and expressing its efficiency are discussed.

Vegetation structure also influences biogeochemical cycles of water and various essential nutrients which in turn affect the rate of net primary production. Vegetation structure through its influence on energy flow and nutrient cycling is extremely important in ecosystem regulation and the maintenance of a natural or a managed steady state.

The human uses of the grassland ecosystem include food derived from grazing animals, human and wildlife habitat, good quality water, germ plasm for domestication and breeding, and the scientific study of the operation of natural and semi-natural ecosystems. In less favorable environments optimum management for all of these uses involves management to maintain the vegetation in a condition somewhat similar to that of the natural steady state, characterized by relatively high net primary production coupled with sufficient diversity to insure stability. In more favorable environments the development of several cultivated ecosystems may be desirable. However, some uses are not served as well by intensively managed monocultures as by native grassland ecosystems in high range condition.

SS02S307,1-23 Thomas, B. O., R. E. Cameron, and J. D. Holmes. 1970. The importance and role of amphibians and reptiles in grassland ecosystems, p. 1-23. *In* R. L. Dix and R. G. Beidleman [ed.] The grassland ecosystem: A preliminary synthesis. *A supplement.* Range Sci. Dep. Sci. Ser. No. 2. Colorado State Univ., Fort Collins.

Amphibian, Reptiles, Amphibian checklist, Reptiles checklist, Food consumption, Amphibian population, Reptiles population, Amphibian ecology, Reptile ecology

The amphibians and (especially) the reptiles are important organisms in the grassland biome. The following extensive review of the literature and synthesis of existing data emphasize the unanswered problems facing herpetological researchers in grassland ecosystems. Reptiles and amphibians are widespread; e.g., 15 of the 44 reptiles and 8 of the 14 species of amphibians listed for Colorado occur on the Pawnee Grassland Site. Population parameters, density, home range, sex and age ratio, etc., have not been determined for many of these organisms at the Pawnee Site. The mobility of some species has been described in the literature for different habitats. Population size, variation and other data concerning these taxonomic documented species are not known. The majority of the terrestrial poikilothermous vertebrates utilize the grassland for only a portion of the year, but during the warm period of the year their positions in the food web and energy flow may be a very important part of the grassland. The trophic levels range from primary consumers of both terrestrial and aquatic ecosystems through secondary as well as mixed consumers of terrestrial ecosystems. Little is known of the endemic amphibians' and reptiles' food consumption in any life history stage of development or biotic coactions. Very little comparative data are available for indices. Most of the existing data are concerned with adaptation to arid environments for amphibians. The amphibian and reptilian biomass per unit area varies with development and time of year. Biomass data are also lacking. The major abiotic factors that influence amphibian and reptilian activity patterns and numbers have not been well investigated. Some information is available for spadefoot toads, but other species have not been scrutinized from the standpoint of associated soil type, climate, etc. The existing energy flow knowledge is deficient for the Pawnee Site.

SS03,1-39 Van Dyne, G. M. [ed.]. 1969. Grasslands management, research, and training viewed in a systems context. Range Sci. Dep. Sci. Ser. No. 3. 39 p.

Models, Modelling concept, Ecosystem model, Producer model, Succession, Simulation

This paper focuses on the role of mathematical modelling and analysis in grasslands research, management, and training. Examples are given of intra-seasonal and interseasonal dynamics models of herbage biomass and of total-system energetics models. A generalized, computer-compatible notation is provided for modelling ecosystems. The complexity of grassland ecosystems imposes an inter-disciplinary team approach for research and management. This complexity also requires a new approach in training. We now must train many grassland scientists and managers as multidisciplinarians to work in interdisciplinary teams.

SS05,1-15 Jameson, D. A. 1970. Basic concepts in mathematical modelling of grassland ecosystems, p. 1-15. *In* D. A. Jameson [ed.] Modelling and systems analysis in range science. Range Sci. Dep. Sci. Ser. No. 5. Colorado State Univ., Fort Collins.

Models, Modelling concept

Mathematical modelling provides a means of organizing our knowledge about complex systems and permits the investigator to conduct a great many experiments on the abstraction of the system in a rapid, inexpensive fashion. Models developed by biologists tend to be of special design and adapted for a particular problem considered pertinent by the biologist. It is often difficult to extend such a model into new or unrelated situations. On the other hand, models developed by mathematicians have better formulation and are more flexible, but there is a tendency to oversimplify the biological world which makes them unreal and perhaps even unusable. A better approach is to prepare models by teams of mathematicians and biologists. The eventual goal of any good ecosystem model is a mechanistic model, that is, one which explains why the various things happen. Good models for biological systems are developed by biologists with the help of mathematicians.

SS05,17-22 Myers, C. A. and P. O. Currie. 1970. Simulation techniques in forest-range management, p. 17-22. *In* D. A. Jameson [ed.] Modelling and systems analysis in range science. Range Sci. Dep. Sci. Ser. No. 5. Colorado State Univ., Fort Collins.

Models, Simulation

A forest-range system can be simulated and examined if we know enough about the relationships involved to model the system. Fortunately, only enough of the system need be modelled to answer the questions raised. Duplication need not be step by step, nor account directly for every factor involved. A word of caution is in order: Simulation is not easy nor is it a magical solution of all our problems. It does appear capable, however, of offering enough benefits to warrant serious consideration as a research and land management tool.

SS05,23-49 Giles, R. H. Jr., and N. Snyder. 1970. Simulation techniques in wildlife habitat managment, p. 23-49. *In* D. A. Jameson [ed.] Modelling and systems analysis in range science. Range Sci. Dep. Sci. Ser. No. 5. Colorado State Univ., Fort Collins.

Models, Simulation

A model has been developed for the rational manipulation of habitat to achieve predetermined objectives. The model is robust, and employs broad-brush techniques well justified in the midst of the inherent variabilities in the natural environment, shifting values and statements of population management objectives, inadequately researched relations of forage quantity and quality to big game in the wild, and the vagaries of sampling both habitats and populations.

Computer manipulation of real and projected data has allowed field *data* to be transformed into usable management *information*. Management decisions, always made under conditions of risk, are dependent upon relevant information if they are to become more objective and to improve. The results of these manipulations of data are not answers; they are inputs for the decision systems of well-educated wildland managers. Their willingness to test and improve the model, to collect more accurate data in just the right quantity, and to do research both in increasing the precision of the vegetation succession curves and the forage quality concept will make the simulator reported here of increasing usefulness. We, however, wish to warn against efforts toward gaining greater precision in the model that cannot be justified within the limits imposed by probability. For example, it would seem unwise for managers in-the-large to expend $20,000 to increase the precision of forage quality measurements by 5% when the normal expected variability of the end calculations may exceed 10%. Control of data and improvement of the program, however, can and should be continuous with time; efforts have been made in the design of the program to expedite such desirable feedback. The efforts at simulation have already provided new insights into the land and its ecology and the nature of the wildlife decision process. Hopefully, by its use and improvement, the simulation can become a powerful tool in the hands of the wildlife manager for making decisions to secure increased resource benefits for man.

SS05,51-74 Goodall, D. W. 1970. Simulation of grazing systems, p. 51-74. *In* D. A. Jameson [ed.] Modelling and systems analysis in range science. Range Sci. Dep. Sci. Ser. No. 5. Colorado State Univ., Fort Collins.

Models, Modelling concept, Simulation

This paper is concerned with parameters and functions of the ecosystem as a whole, such as productivity, rather than the individual species and populations of which it is composed. Management of a pastoral property is centered on the management of an ecosystem and in understanding the dynamics of such a complex system, and in predicting the outcome of proposed modifications, computer simulation can play an important role.

To be useful for pastoral management, a model needs to be able to provide as output the quantity of useful products produced up to any particular point in time. The input would include the initial inventory, the changes to be imposed by managerial action, and meteorological data. The paper develops an ecosystem model and discusses its use in context of management.

SS05,75-87 Bell, F. 1970. An example of optimization techniques in land management: The Eldorado model, p. 75-87. *In* D. A. Jameson [ed.] Modelling and systems analysis in range science. Range Sci. Dep. Sci. Ser. No. 5. Colorado State Univ., Fort Collins.

Models, Optimization, Resource model

The Eldorado model is described as an example of optimization techniques in land management. The model uses linear programming to handle the input-output relationships and to recognize and evaluate the effects of imposing or relaxing constraints. The model consists of a matrix generator, linear programming, and a report generator. The usefulness of the model lies in the following characteristics:

1. It considers the joint effect of inputs on outputs.
2. It gives the manager a tool to explore a series of alternatives.
3. The model focuses attention on specific goals rather than broad overall objectives.

SS05,89-100 Price, F. E. 1970. An example of optimization techniques in land management: The resource allocation model, p. 89-100. *In* D. A. Jameson [ed.] Modelling and systems analysis in range science. Range Sci. Dep. Sci. Ser. No. 5. Colorado State Univ., Fort Collins.

Models, Optimization, Resource model

A Resource Allocation Model developed by Daniel Navon of the Pacific Southwest Forest and Range Experiment Station in Berkeley, California was programmed to simulate various alternative timber management programs as a demonstration. The results obtained are discussed in the paper.

SS05,101-110 Shiflet, T. N. 1970. Data acquisition, storage, and retrieval for range ecosystem planning, p. 101-110. *In* D. A. Jameson [ed.] Modelling and systems analysis in range science. Range Sci. Dep. Sci. Ser. No. 5. Colorado State Univ., Fort Collins.

Data processing, Data acquisition

The Range Data System is closely correlated with the data systems in soils, woodland, and others. This is important for exchanging information such as detailed profile information or chemical data from a particular soil on which we were studying the vegetation.

This system applies not only to rangeland but to grazable woodland (forest range), and native pasture (a term used by SCS to mean land whose climax is forest but is being managed as native disclimax grassland). The system described here is, however, by no means complete. It probably has "bugs" in it that we have not dreamed about. However, we feel that we are on the right track in developing a system that will improve our range planning skill and enable us to better serve cooperators.

A few things that we have learned at this stage of development are:

1. Quality control and editing must be exercised from field level to the data center.
2. Raw data, rather than interpretations, should be stored, to the extent possible.
3. Computers should be programmed to do most of the medial tasks of data manipulation.

4. Correlation with other disciplines within the same agency is essential.
5. Such a system must be flexible and open-ended.

SS05,111-134 Jameson, D. A. and L. J. Bledsoe. 1970. Models and selection of experiments, p. 111-134. *In* D. A. Jameson [ed.] Modelling and systems analysis in range science. Range Sci. Dep. Sci. Ser. No. 5. Colorado State Univ., Fort Collins.

Models, Modelling concept

Initial models should utilize all pertinent existing information, and perhaps should be developed to a considerable extent before much experimentation is initiated. Following the initial model design and implementation, the models should be tested against the data gathered by experimentation. The results of this comparison are utilized to guide the second round of experimentation and model redesign. Research in ecosystem components and ecological processes can be guided by component and processes models. Conduct of research in whole ecosystems, however, requires whole ecosystem models. No matter how crude, total system models must precede detailed component and process models. A greatly simplified ecosystem model is used as an example of application of modelling to grassland ecosystems.

The formulation of an optimization model provides a convenient method of selecting research priorities. A model for a whole ecosystem is more valuable than a model for a process or a small part of an ecosystem. Similarly, a model having high resolution is more valuable than a model with low resolution.

SS06I,2-74 Bryson, R. A., B. Hayden, V. Mitchell, and T. Webb III. 1970. Some aspects of ecological climatology of the Jornada Experimental Range New Mexico, p. I-2 - I-74. *In* R. G. Wright and G. M. Van Dyne [ed.] Simulation and analysis of dynamics of a semi-desert grassland: An interdisciplinary workshop program toward evaluating the potential ecological impact of weather modification. Range Sci. Dep. Sci. Ser. No. 6. Colorado State Univ., Fort Collins.

Jornada, Climate, Meteorology, Solar radiation, Vapor pressure, Air temperature, Precipitation, Runoff, Vegetation types, Primary production, Wind, Atmospheric water, Heat transfer, Models, Precipitation model, Evaporation, Evapotranspiration, Simulation

This report consists of three main parts: An analysis of the standard climatic factors that appear to limit the plants of the Jornada, an analysis of heat and moisture budgets appropriate to the cover types of the Jornada, and a preliminary estimate of the spatial and seasonal patterns of precipitation in equation form for use in a computer model. The annual trends of climatic parameters like temperature, dew, humidity, precipitation, runoff, and wind were determined for the phytogeographic regions of mesquite, creosote bush, tarbush, burrograss, tobosa grass, mesa dropseed, and black grama. Energy and mass budgets were considered in detail for the three predominant vegetation types, viz., sand dunes with mesquite, shrubland, and grassland. A quantitative expression for rainfall as a function of time and space has been developed.

SS06I,75-99 Clymer, A. B. and L. J. Bledsoe. 1970. A guide to the mathematical modelling of an ecosystem, p. I-75 - I-99. *In* R. G. Wright and G. M. Van Dyne [ed.] Simulation and analysis of dynamics of a semi-desert grassland: An interdisciplinary workshop program toward evaluating the potential ecological impact of weather modification. Range Sci. Dep. Sci. Ser. No. 6. Colorado State Univ., Fort Collins.

Jornada, Models, Modelling concept, Ecosystem model, Jornada model

This paper proposes a framework for the modelling of an ecosystem, particularly the Jornada Range ecosystem. The methods presented in this paper seem to us to be a rational way of approaching the understanding of whole, naturally-occurring ecosystems. It is realistic in the sense that there is space for the inclusion of the ideas and conceptions of many specialists, biological and otherwise. In fact, this feature is regarded as essential and the key factor which makes this approach distinct from traditional methods of attacking ecological problems. No single individual is capable of modelling (i.e., understanding and interpreting in detail) an entire ecosystem. It is not the case that the systems modellers per se (i.e., mathematicians) develop the model; as explained in Bledsoe and Jameson (1969) a joint effort is required.

In this regard, the equations developed herein, having been derived without the required interaction, are to be regarded as a framework within which modification can take place. Any biological specialist can spot areas where the equations do not take advantage of the full, existing knowledge in his area. This is the result of the free exercise of the authors' imaginations without the proper benefit and sobering influence of applied specialists. What, then, is the purpose of the mathematical parts of this paper? To illustrate a method: how a conception of many detailed, interacting biological mechanisms may be incorporated into a unified, mathematically expressed, system, and how this system can be used to explore automatically (by computer) the total logal consequences of the detailed mechanisms. If individual scientists correctly understand, separate fragments of environmental biology, then it must be possible to assemble these fragments into an understanding of the whole. If this is not possible, then the detailed fragments are at fault. It is not possible for an individual to assemble all of the details at once and deduce their combined effect. Thus man may not be aware of exactly what he does know about his natural environment, without some help from his automated logical machines. This constitutes the basis for the whole rationale of ecosystem modelling.

Application of the techniques of mathematical modelling to the Jornada range will require extensive revision and extension of our equations and substitution en masse for some submodels. However, this paper will have accomplished its purpose if the reader can say of some parts "I can formulate those equations more realistically" or even "that equation doesn't describe what really happens."

SS06I,100-118 Collins, D. D. 1970. Climate-plant relations affecting semi-desert grassland hydrology, p. I-100 - I-118. *In* R. G. Wright and G. M. Van Dyne [ed.] Simulation and analysis of dynamics of a semi-desert grassland: An interdisciplinary workshop program toward evaluating the potential ecological impact of weather modification. Range Sci. Dep. Sci. Ser. No. 6. Colorado State Univ., Fort Collins.

Hydrology, Interception, Infiltration, Infiltration rate, Evapotranspiration, Atmospheric water

This paper is concerned with those portions of the overall hydrologic cycle that are influenced by vegetational relationships. Data on interception of precipitation by a number of grasses, forbs, and planted crops have been summarized. Influence of mulch on interception and infiltration has been discussed. A review of the literature concerning the influence of vegetation, particularly through roots and leaves, on the evapotranspiration is presented, and an attempt has been made to evaluate the relative importance of various types of vegetation influences with respect to the modelling of hydrologic cycle.

SS06I,119-128 Cooper, C. F. 1970. Hydrology and water balance of semi-desert soils, p. I-119 - I-128. *In* R. G. Wright and G. M. Van Dyne [ed.] Simulation and analysis of dynamics of a semi-desert grassland: An interdisciplinary workshop program toward evaluating the potential ecological impact of weather modification. Range Sci. Dep. Sci. Ser. No. 6. Colorado State Univ., Fort Collins.

Hydrology, Infiltration, Runoff, Erosion, Evaporation, Interception, Potential evapotranspiration, Field capacity, Soil water, Transpiration, Atmospheric water

The paper presents a review of literature on some important hydrologic aspects of soils in semi-desert regions, emphasizing processes and quantitative values useful in simulation models. Topics covered are: interception; infiltration and factors affecting infiltration; overland flow, subsurface flow, and erosion; evaporation and transpiration; and dew. The paper also proposes a flow diagram of processes of water movement in semi-desert soils.

SS06I,129-132 Goodall, D. W. 1970. Modelling the growth of plants in semi-arid grassland, p. I-129 - I-132. *In* R. G. Wright and G. M. Van Dyne [ed.] Simulation and analysis of dynamics of a semi-desert grassland: An interdisciplinary workshop program toward evaluating the potential ecological impact of weather modification. Range Sci. Dep. Sci. Ser. No. 6. Colorado State Univ., Fort Collins.

Models, Plant growth, Modelling concept, Plant growth model

The importance of morphogenesis, changes during development, interorganal competition for labile materials, and the factors controlling the flow rates, with respect to plant-growth model, has been examined. The analogy between the author's conception of plant growth and morphogenesis, and certain electrical and hydraulic systems is emphasized. The proposed model is based on demand intensity (p_i), conductivity for each organ or organ group (c_i), rate of photosynthesis (Q), and flow rate (f_i).

SS06I,133-177 Herbel, C. H., P. L. Dittberner, and T. S. Bickle. 1970. A quantitative ecology of the Jornada Experimental Range, p. I-133 - I-177. *In* R. G. Wright and G. M. Van Dyne [ed.] Simulation and analysis of dynamics of a semi-desert grassland: An interdisciplinary workshop program toward evaluating the potential ecological impact of weather modification. Range Sci. Dep. Sci. Ser. No. 6. Colorado State Univ., Fort Collins.

Jornada, Microclimate, Soil water, Precipitation, Air temperature, Soil temperature, Evaporation, Plant growth, Plant cover, Yield, Grazing influence, Solar radiation, Infiltration, Seedling survival, Cover, Longevity, Stocking rate

The Jornada range consists of unconsolidated pleistocene detritus, and is most arid of the North American grasslands. Physiography, climate, wildlife, insects, and vegetation of the area are briefly described in the paper. A brief stocking history is also given. Amount of precipitation needed to moisten 4 inches of dry soil varies from .68 to 2.86 inches. Some 75 to 90% of the observed soil water is contributed by run in. Surface soil temperatures are usually very high (57°C in July with no surface cover, as compared to 33°C maximum air temperature at the same time). Seedling survival and growth of a number of species at different soil moisture and temperature regimes have been examined. The relation of plant cover and yield to precipitation is discussed and data for life-span of common plants are included. Effects of drought, wildlife, and grazing management are discussed.

SS06I,178-190 Houston, W. R. 1970. Reciprocal influences between domestic animals and their components of semi-desert ecosystems, p. I-178 - I-190. *In* R. G. Wright and G. M. Van Dyne [ed.] Simulation and analysis of dynamics of a semi-desert grassland: An interdisciplinary workshop program toward evaluating the potential ecological impact of weather modification. Range Sci. Dep. Sci. Ser. No. 6. Colorado State Univ., Fort Collins.

Grazing influence, Cattle, Mammals, Gestation, Lactation, Wheatgrass, Food composition, Cattle nutrition, Plant nutrients, Metabolic rate, Cattle metabolism, Sheep, Food chemical composition, Range condition

The paper examines the mutual relationship between physical environment and domestic animals. The nutrient content of native plants and nutrient requirements for livestock during gestation and lactation are given. Problems in management planning, vegetation resource inventories, and grazing capacity measurements have been briefly considered. Grazing influence, range development in relation to climate, and ranch economics are also discussed.

SS06I,191-197 Jameson, D. A. 1970. Stochastic ability and secondary succession, p. I-191 - I-197. *In* R. G. Wright and G. M. Van Dyne [ed.] Simulation and analysis of dynamics of a semi-desert grassland: An interdisciplinary workshop program toward evaluating the potential ecological impact of weather modification. Range Sci. Dep. Sci. Ser. No. 6. Colorado State Univ., Fort Collins.

Succession, Models, Modelling concept

The concept of deterministic stages of plant succession is widespread in ecology. Such concepts have been useful and the processes may actually be operating in many cases, particularly in primary succession. Such stages, however, may occur as a result of stochastic processes coupled with certain intrinsic properties of the species involved, at least in secondary succession. Plant longevity is often inversely related to ease of establishment. Thus easily germinated species, such as annuals, are more likely to dominate earlier stages of plant succession, but these plants will gradually give the way to species which are longer lived even though they become established less often. When establishment of long lived species is more probable, stability of the community will occur relatively rapidly, but when establishment of long lived species is less probable, annual and short lived perennial species may dominate the site for many years and the communities will be less stable.

The scope of the factors determining establishment are also very important. If establishment is governed by localized factors which influence only a small proportion of the total area, stability of the total community is rapidly achieved. If, on the other hand, establishment is governed by broad scale factors, the picture is one of great community instability. For plant communities local factors might be likened to such things as soil, while broad scale factors might include climate.

The relative importance of local versus broad scale factors can be determined in a simulation of community behavior by varying the importance of local versus broad scale factors until the time variance of the simulated population approximates that of the real population being studied.

SS06I,198-212 Laycock, W. A. 1970. Life history, food habits, habitat requirement, and population dynamics of small herbivores on semi-desert grasslands, p. I-198 - I-212. *In* R. G. Wright and G. M. Van Dyne [ed.] Simulation and analysis of dynamics of a semi-desert grassland: An interdisciplinary workshop program toward evaluating the potential ecological impact of weather modification. Range Sci. Dep. Sci. Ser. No. 6. Colorado State Univ., Fort Collins.

Mammals, Rodent, Rodent density, Kangaroo rat, Jackrabbit, Rodent biomass, Jackrabbit biomass, Food composition, Ingestion, Feeding habit, Mammal density, Mammal biomass, Life history, Habitat

The paper presents some basic data on the life history, food habits, and population of rodents and rabbits on semi-desert grassland ranges in southwestern United States. The paper constitutes a general treatment of all species and a specific section on jackrabbits. Habitat preferences for various species are given. Data on the population and food consumption by *Dipodomys ordii*, *D. merriami*, *D. spectabilis*, *Neotoma albigula*, *N. micropus*, *Onychomys leucogaster*, *Perognathus penicillatus*, and *Reithrodontomys megalotis* are included. Effect of increased precipitation on rodent population is discussed.

SS06I,213-217 Stoddart, L. C. 1970. Life history and population dynamics of the black-tailed jackrabbit (*Lepus californicus*) in New Mexico, p. I-213 - I-217. *In* R. G. Wright and G. M. Van Dyne [ed.] Simulation and analysis of dynamics of a semi-desert grassland: An interdisciplinary workshop program toward evaluating the potential ecological impact of weather modification. Range Sci. Dep. Sci. Ser. No. 6. Colorado State Univ., Fort Collins.

Jackrabbit, Jackrabbit growth, Jackrabbit density, Mammals, Ingestion, Jornada, Growth rate, Natality, Mortality

Literature on the growth rate and size, food habits, natality, mortality, and density of black-tailed jackrabbits is briefly reviewed and some pertinent data are included.

SS06II,1-69 Wright, R. G. and G. M. Van Dyne. 1970. Results of workshop groups, p. II-1 - II-69. *In* R. G. Wright and G. M. Van Dyne [ed.] Simulation and analysis of dynamics of a semi-desert grassland: An interdisciplinary workshop program toward evaluating the potential ecological impact of weather modification. Range Sci. Dep. Sci. Ser. No. 6. Colorado State Univ., Fort Collins.

Jornada, Climate, Precipitation, Soil water, Air temperature, Soil temperature, Models, Infiltration, Potential evaporation, Albedo, Computer programs

Ecology has long been recognized as a multidisciplinary and integrative science. It has recently been recognized that the ecosystem is a fundamental unit of study in basic ecology and that the management of renewable resources should be undertaken in an ecosystem framework. The techniques of systems ecology will be applied to solving tomorrow's resource management problems. However, such a new resource management is limited by the number of available qualified practitioners having ability to condense and synthesize a body of information about a resource problem and present it in an analytical framework useful in decision making. One of the major goals of this project was to develop, as an experiment, a workshop focusing on an ecological problem of real-life complexity and relevance and utilizing the workshop format as an educational approach. The broad overall problem selected was that of examining the ecological impact of weather modification on a semi-desert grassland range.

A problem area in southern New Mexico was selected where data were available on long-term changes in the system, especially the vegetation, as a response to naturally occurring climatic fluctuations. The objective here was to try to extract from experience, the literature, and the data base enough information about the system to represent it in simulation models. Analysis of this total-system problem required crossing disciplines to secure personnel with adequate subject matter and analytical capabilities, operational approaches, and flexibility in attitude, outlook, and operation.

The procedure followed was: (i) We sent a field crew to the research site in summer, 1968, to collect all available climatic and vegetation records for subsequent analysis; (ii) An organizational meeting of 12 scientists was held in late October, 1968, at the field site to view the experimental area, make plans for continuing work, and develop the broad guidelines for a workship; (iii) Review papers were structured by ten scientists during the fall, winter, and spring, 1968 to 1969. Also, during that time, additional papers from the literature, results of analyses of soil samples from the experimental area, and results of analyses of climatic data from the area were distributed to participants; and (iv) A workshop was held for two weeks in late June, 1969 at the University of New Mexico. Some 14 senior scientists and 16 graduate students representing eight universities, one major laboratory, and a private consulting firm, worked together intensively for two weeks on four trophic-level models and one top-echelon total-system model. The participants came from highly varying disciplines including climatology, botany, natural resource management, ecology, agriculture, and applied mathematics. The work included analysis of data, structuring of differential equations, and coding these into computer programs utilizing a remote-terminal system.

This report presents a detailed evaluation of the problem, the approach to it, the results of the workshop, and an evaluation of the workshop format. Also appended are the ten working papers prepared for and presented at the workshop. Example computer programs, within input and output, are provided along with example tabular and graphic output prepared and distributed before and during the workshop. These data are provided as a basis for further investigation into techniques for training for ecological systems analysis and for organizing research programs, either of short or long duration, for the study of complex ecological problems.

Generally, it was regarded that the two-week workshop, with the preparatory activities listed, was insufficient time to develop a highly mechanistic, completely valid systems model. However, a top-echelon model was developed and did run although the output reflects a great need for evaluation and adjustment of coefficients in the differential equations composing the model. The model was not developed in time and to the stage to allow detailed evaluation of potential ecological impact of weather modification by varying the climatic forcing functions within the model and examining output such as plant and animal biomass or plant cover changes. The workshop was regarded as highly successful from the standpoint of the training goals.

SS07,45-46 Van Dyne, G. M. 1970. Structuring of ecosystem studies on an international basis, p. 45-46. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Models, Modelling concept

Systems approach is a systematic consideration of problems wherein analysis, rather than intuition, is stressed in seeking a course of action. Modelling is a very important part of systems analysis and synthesis. Models include word models, picture models, and numerical or analytical models. They should be taken in that sequence. Static models are the usual statistical models while dynamic models include many of the simulation models designed to study the relationships between variables over time and over space. The discrete simulation models are those in which we calculate or think of the events occurring in steps. When these steps are small enough, we are talking about continuous models. The paper outlines some basic approaches that are used to introduce synthesis, to introduce integration, and to introduce communication and information exchange into the U.S. IBP Grassland Biome studies.

SS07,58 Jameson, D. A. 1970. Problems in measuring grassland productivity, p. 58. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Primary production

The problems in measuring primary productivity in grassland ecosystems are outlined. The rate of change in aboveground plant biomass can be arrived at by subtracting the amount transferred out from the net photosynthesis; and in belowground plant biomass the rate of change is the transfer into the belowground parts minus death of the belowground parts, minus harvested belowground parts, and minus the respiration rate of the belowground parts. Alternatively, productivity can be determined through the increments in biomass, provided sampling is adequate.

SS07,60-61 Sims, P. L. 1970. Studies of producer biomass at the Pawnee Site, p. 60-61. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Pawnee, Field data procedures

The procedures for the measurement of plant biomass at the Pawnee Site are briefly described. The aboveground herbage from the four grazing treatment areas, viz., none, light, medium, and heavy grazing, is sampled through double sampling technique. Root sampling is done at the following depths: 0-10, 10-20, 20-40, 40-60, and 60-80 cm. Each of the samples to 40 cm in depth is of a 3-inch core, and for greater depth, a 1-inch core.

SS07,62-64 Van Dyne, G. M., F. M. Smith, and L. J. Bledsoe. 1970. Techniques in measuring biomass of producers, p. 62-64. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Field data procedures

Warm-season and cool-season grass species represent two broad categories of species occurring in North American grasslands. The cool-season species begin with a growth spurt early in the year and die off as warmer weather and drier conditions occur. In warm-season species there is a much less pronounced growth spurt early in the season, and often, there is a cessation of growth during dry periods with a recovery following summer rains. Different sampling intensities as a function of the species being measured and of the time of the year need be used.

The paper describes and discusses the use of double-sampling techniques. The double-sampling method improves the variability of quick techniques, like visceral estimation of dry weight and dry weight rank technique by calibrating them against a small amount of laborious and tedious, but more accurate sampling, live clipping method.

SS07,65 Jameson, D. A. 1970. Use of the electronic metre in estimating biomass, p. 65. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Field data procedures

The use of the electronic herbage metres, which are based on the fact that the resonant frequency of the circuit changes as the dielectric constant between the probes is changed, in determining plant biomass is discussed. Problems associated with such herbage metres are identified.

SS07,70 Hansen, R. M. 1970. Objectives of consumer studies at the Pawnee Site, p. 70. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Pawnee

In consumer studies an index of similarity as a guideline for the basic data is a very powerful tool available. Similarity matrices could be made up for food preferences for one species, or for a comparison of habitat of one species of consumer with the habitat of another species of consumer, or for comparing one sample with another. The diet technique used on the Pawnee Site is based on microscopic examination of the material, whereby frequency per microscopic field is converted to density per microscopic field and then to relative density. Fistulated animals will also be used for determining percentage dry weight of food in the diet.

SS07,77-83 Wiens, J. A. 1970. Habitat heterogeneity and avian consumer populations in grasslands. p. 77-83. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Birds, Species diversity, Bird density, Bird biomass, Pawnee

Avian populations and habitat characteristics were determined at 15 study sites in the United States, four of which were on the Pawnee Site. All populations were measured at the peak of the breeding season. The index of habitat heterogeneity is based on measures of vertical vegetation density taken at point samples located within the study plot using a stratified random sampling design.

With the increase in habitat heterogeneity, the standing crop biomass of birds decreases markedly. The degree of niche differentiation and species densities seem to be limited in similar ways over a wide range of grassland conditions. The horizontal habitat heterogeneity also influences the size of the territories occupied by different species.

SS07,84-85 Baldwin, P. H. 1970. Avian food studies at the Pawnee Site, p. 84-85. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Pawnee, Birds, Food composition

Collecting of specimens and analytical work to date have centered upon, although not confined to, the Lark Bunting, which is the most common summer resident among the small species of insects and seed eaters. An examination of 74 stomachs collected during the first eight weeks of summer revealed that the Lark Bunting eats about three times as much insect material as it does plant food. Detailed procedures for the study of stomach contents of birds are outlined.

SS07,89-91 Ryder, R. A. 1970. Avian populations at the Pawnee Site, p. 89-91. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Pawnee, Birds, Bird density, Horned Lark, McCown's Longspur, Meadowlark, Lark Bunting, Brewer's Sparrow, Bird biomass

Preliminary observations and a review of past work indicate that 168 species of birds occur on the Pawnee Site. Out of these about 25 species regularly breed locally; 12 are recorded as winter residents only, while the rest are merely migrants through the area. Horned Larks are the dominant breeders and the most abundant winter residents, followed by the Lark Bunting The total avian breeding biomass is calculated to be 6.5 kg/120 acres or 0.0134 g/m^2 (wet weight). Data on density, biomass, and nesting are presented.

SS07,107-108 Doxtader, K. G. 1970. Biomass determinations of soil microorganisms, p. 107-108. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7 Colorado State Univ , Fort Collins.

Pawnee, Soil ATP, Microflora, Fungi, Fungi biomass, Microbial biomass

The techniques for the determination of microbial biomass in soil being used at the Pawnee Site are described. These include (a) plate count method, (b) direct count method, and (c) chemical method. In plate count method organisms are isolated on petri dishes containing appropriate nutrient agar. In direct count, the sample of soil is diluted, placed on a microscope slide, and the number of bacterial cells is counted after appropriate staining. In the case of fungi, the mycelial strands are sketched and their diameter and length measured. From these values the total volume of mycelium and the weight of mycelial mass per soil sample are calculated. The method, however, presents difficulties with actinomycetes. The bacterial dry weight ranges from 0.08 to 0.13 mg/g soil to a depth of 80 to 90 cm. Values for fungi range from 0.1 to 0.33 mg/g of soil to a depth of 90 cm. One of the chemical methods tried in this context is the determination of ATP. Attempts were made to relate the ATP content from bacterial isolates to the biomass values estimated through plate count. Relationship seems to be good. Inoculated sterile soil was also used in these experiments. The technique is being perfected.

SS07,112-120 Mayeux, J. V. and E. A. Jones. 1970. Distribution of microorganisms in Pawnee Site soil profiles, p. 112-120. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Pawnee, Microbial density, Bacteria, Bacteria density

The bacterial population in the soils of ungrazed exclosures, lightly-grazed areas, and heavily-grazed areas on the Pawnee Site was determined through plate count technique. The details of the procedure are described. The samples taken below 45 cm generally had a bacterial population of less than 10×10^6/g of soil, while the values for the upper layers ran up to 75×10^6/g. The preliminary results of population estimation on the four major grazing treatments indicated that there may be differences in the bacterial population detected by the plate count technique. The experiments with triplicate core samples indicated that it is possible to get as much difference in counts within a treatment as among treatments.

SS07,150 Burman, R. D. 1970. Plans for instrumentation at the Pawnee Site, p. 150. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Instrumentation, Pawnee

A 36-channel recording system for the micrometeorological measurements which will be used at the Pawnee Site is briefly described. The reflective shortwave radiation will be measured with Kipp solarimeters, and the incoming longwave radiation by a special instrument ordered from Eppley. The total net radiation will be measured by Beckman and Whitley instruments. Soil heat flux will be studied by the usual soil heat flow discs. Wind speed, wind direction, air temperature, soil temperature, and barometric pressure will also be measured. This system is compatible with the Bowen ratio or the energy balance concept of modelling. In addition, a portable system which will have a total of 72 channels and which is compatible with the idea of profile analysis will also be used. The need for a lysimeter to aid in nighttime measurements is identified.

SS07,151-154 Moir, W. H. 1970. A photosynthesis measurement system for the Pawnee Site, p. 151-154. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Pawnee, Photosynthesis, Instrumentation

A photosynthesis field measurement system of considerable flexibility of application has been developed and is briefly described here. The electronic components are housed in a trailer. A satellite to this trailer is a small hemispherical dome, the basic CO_2 monitoring device is an infrared gas analyzer. The field plexiglass dome constitutes the sample observation unit and allows transmittance of visible light at about 90%. Air temperature within the dome is regulated by a 0.5 hp compressor-cooler with an electronic feedback system. A variac regulator allows circulation within the dome at simulated wind speeds. Atmospheric composition (CO_2 and water vapor) is controlled by a flushing system. Some preliminary data on CO_2 exchange obtained with this system are presented.

SS07,174 Striffler, W. D. 1970. Hydrological cycle of grasslands, p. 174. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Hydrological cycle, Pawnee

The approach to the study of the hydrological cycle at the Pawnee Site is briefly outlined. The hydrological cycle is considered a very simple system with precipitation as the input and runoff as the output and with several intermediate functions. The latter determine the relationship between the inputs and outputs. Some of the measurements on eight micro-watersheds concerning hydrological cycle include rainfall, runoff, soil moisture, temperature, and evapotranspiration.

SS07,176-178 Van Dyne, G. M. 1970. Introduction, p. 176-178. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Models, Modelling concept

Several major general problems in modelling are briefly discussed. The first problem with any modelling effort is the acquisition of good and adequate data. Individual data must be reported along with means, variances, regressions, correlations, etc. Besides, the data must be described and the sample design used should be identified. The literature synthesis, in which the mechanisms that only the individual biologist and physical scientist understand are explained, is the major communication for the biologist and the modeller. Some of the kinds of communication problems that are encountered, in addition to language barriers, are the problems of the clarity of diagrams and flow charts. We should try to make our mathematical notation explicit and clear. Potential for generalized ecological notation and modelling approaches is discussed.

Models are not only of different kinds and different purposes, but also of different levels and intensities. Sensitivity analysis is one way that models can feed back to experiments. The need of interaction between modelling and experimentation is emphasized. Further, modelling involves analysts, interacters, or modelling referees, and it involves the experimenters. The models ultimately should help in making ecological predictions with some precision.

SS07,191-198 Van Dyne, G. M. 1970. Examples of trophic level and total ecosystem models, p. 191-198. *In* R. T. Coupland and G. M. Van Dyne [ed.] Grassland ecosystems: Reviews of research. [Proc. September 1969 Meeting PT Grasslands Working Group, International Biological Programme, Saskatoon and Matador, Saskatchewan, Canada]. Range Sci. Dep. Sci. Ser. No. 7. Colorado State Univ., Fort Collins.

Models, Producer model, Succession, Ecosystem model

The paper describes two compartment models, the one is an interseasonal dynamics model and the second is an intraseasonal vegetation dynamics simulation model, and a total ecosystem model. The interseasonal model includes five different plant communities and a litter box. In contrast to this model, the intraseasonal model is concerned with the changes in aboveground and belowground plant biomass within a year and includes a driving force. Both are single trophic level models. In the total system model, all trophic levels are represented. In this there are abiotic components, at least to the effect of the climatological inputs. There are producer components, consumers of various kinds, and decomposers. All three of these models are relatively non-intensive in terms of the amount of biological and physical detail put into them. However, they provide a guide for going ahead with the task of analysis of the functioning of whole ecosystems.

SS10,1-9 Van Dyne, G. M. 1971. The U.S. IBP Grassland Biome study--an overview, p. 1-9. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep. Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Site description, Models, Modelling concept, Ecosystem stress, Biome objectives

The Grassland Biome study was originated as part of an Analysis of Ecosystems program in the United States' contribution to the International Biological Program. The overall purpose of the IBP is to examine "the biological basis of productivity in human welfare." The dévelopment of the Grassland Biome program since its first implicit outline in October 1966 is traced to date.

The need for the development of mathematical models as a mechanism of synthesizing the information into a whole as the program progresses is stressed.

The widely-distributed study sites should provide the kind of data needed to test the generality of mathematical models being developed for these ecosystems.

The inclusion of experimental stress treatments into the program allows testing of the hypothesis concerning interrelations of structure and function developed by intensive surveys. Organization of research within the Grassland Biome program is briefly outlined.

SS10,11-34 Rasmussen, J. L. 1971. Abiotic factors in grassland ecosystem analysis and function, p. 11-34. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Heat balance, Water balance, Solar radiation, Air temperature, Wind, Precipitation, Runoff, Evaporation, Energy balance, Evapotranspiration, Potential evapotranspiration, ALE, Osage, Bison site, Hopland, Jornada, Pantex, Pawnee, Bridger, Dickinson, Cottonwood, Hays, Climate, Meteorology

The time and space distributions of the abiotic driving forces are the topics of consideration of this paper. The climate as defined by solar radiation, temperature, precipitation, evaporation, runoff, and wind is discussed. The distribution of these quantities across the grassland of the United States is shown by a series of maps developed from the long-term climatic records. Discussion of these parameters is focused on the factors that delineate the boundaries of the grassland and variations within the grassland area.

A simple energy and water balance of the earth-atmosphere interface is described (Thornthwaite-Mather model), and the model is applied to the mean monthly data at each of seven IBP Grassland Biome intensive observation plots. Characteristic soil moisture variations for each site are computed, and intersite comparisons are made. An identical analysis is performed for the 1970 data at each site. Variations in 1970 soil moisture between sites as well as deviations from the long-term average are noted.

SS10,35-40 Reuss, J. O. 1971. Soils of the Grassland Biome sites, p. 35-40. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep. Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Pawnee, Soil types, Water storage, Soil depth, Solum depth, ALE, Bison site, Bridger, Cottonwood, Dickinson, Hays, Jornada, Osage, Pantex, Soil physical characteristics, Soil chemical characteristics

Although widely separated geographically and formed on diverse parent materials, nine of the ten dominant soils on the biome sites are classified in the Mollisol order. This order is comprised mainly of the dark, base rich soils of the semiarid and subhumid steppes. Even though they are consistent as to order, the soil properties vary widely. Texture varies from silty clay to loamy sand. Depth to bedrock varies from 35 to greater than 150 cm, and estimated available moisture storage capacity to 100 cm depth varies from 4.5 to 20 cm. While a few are acidic in the surface, with the exception of the mountain grassland, the soils tend to be largely base saturated. Native vegetation could be expected to respond to nitrogen fertilizer during periods when moisture availability is not limiting growth. Phosphorus responses might be expected at some sites. It is unlikely that native vegetation will respond to additions of other nutrients on these soils.

SS10,41-58 Risser, P. G. 1971. Plant community structure, p. 41-58. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep. Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Vegetation structure, Leaf height, Biomass family relationship, Biomass category relationship, Intersite comparison, Species diversity, Cool grass, Phenology, Bluestem, Grazing influence, Plant pattern, Species association, Osage, Hays, Bison site, Bridger, Dickinson, Pantex, Pawnee, Jornada, Cottonwood, Warm grass, Plant diversity, Aboveground plant biomass, Leaf area index

The 1970 field season data show that 65% of the aboveground plant biomass on the Grassland Biome study sites was composed of grasses and that the tribes Andropogoneae and Chlorideae and the family Compositeae contribute well over half the total live biomass. The Hays, Osage, Bison, and Bridger Network Sites have bunchgrasses as the dominant growth form, while Jornada, Pantex, and Pawnee have mostly sod grasses. Dickinson and Cottonwood have a substantial representation of both growth forms. If the Network Sites are ordinated by either floral or vegetational similarities, the resulting configurations are very similar and closely approximate a site ordination based on environmental variables. There appears to be a general increase in phenological diversity with an increase in the amount of live standing crop.

The concepts of pattern, species diversity, and aerial cover were evaluated on only a few sites, so biome wide comparisons were not possible. Phenology was measured throughout the 1970 growing season, but the interpretation of these data has proved difficult. Certain elementary characteristics such as height of vegetation, and proportion of warm and cool season grasses, showed a consistent relationship across the network. However, one of the most interesting aspects of the grassland structural data is the fact that many characteristics do not show a uniform response, indicating the multitude of adaptive strategies employed within the grassland ecosystem.

SS10,59-124 Sims, P. L. and J. S. Singh. 1971. Herbage dynamics and net primary production in certain ungrazed and grazed grasslands in North America, p. 59-124. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep. Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Site description, Dickinson, Bison site, Bridger, Pawnee, Cottonwood, Hays, Pantex, Osage, Jornada, Growing season, Solar radiation, Air temperature, Soil temperature, Precipitation, Potential evapotranspiration, Evapotranspiration, Solum depth, Water storage, Aridity index, Cool grass, Warm grass, Cool forb, Warm forb, Cool succulent, Warm succulent, Cool shrub, Warm shrub, Biomass category relationships, Grazing influence, Aboveground plant biomass, Belowground plant biomass, Standing dead, Litter, Primary production, shoot-root ratio, System transfer function, Efficiency energy capture, Root turnover, Annual increment, Root annual increment, Decomposition, Decomposition litter, Litter decomposition, Decomposition root, Root decomposition, Principal component analysis, Litter accumulation, Plant energetics

Nine U.S. IBP Grassland Biome sites are characterized according to the abiotic and vegetational characteristics and their relationship to grazed and ungrazed conditions by analysis and synthesis of 1970 field data. Abiotic characteristics including length of growing season, usable solar radiation, mean annual temperature, mean annual precipitation, potential and actual evapotranspiration, and aridity indices are used to interpret intraseasonal herbage dynamics and net primary productivity. Synthesis of vegetation data involved categorization of plant species into cool and warm season vegetation classes (grasses, forbs, shrubs, and succulents) and into compartments by live, current year's dead, old dead, litter, and belowground plant material. The belowground biomass is characterized according to the seasonal average and peak biomass, percentage of total plant biomass situated belowground, and the vertical distribution of this material. Annual increment and turnover rates are presented. The relationship of these characteristics to abiotic factors is examined. Estimated net primary productivity and accumulation rates are calculated for ungrazed and grazed grasslands on each site. These data are further analyzed by evaluation of system transfer functions and efficiency of energy capture by various vegetation compartments.

Results show that grasses are the most important class of vegetation. Cool season species dominate some northern sites, warm season species the southern sites, while some sites have both types. Other vegetation classes not having significant production are, however, important in explaining variability in grazing treatments. Vegetation compartments show similar intraseasonal dynamics, but still reveal interesting site characteristics. Belowground biomass parameters (state variables) show characteristic time and space relationships. Abiotic factors (driving variables), such as mean annual temperature, assist in explaining these relationships. Net primary productivity and accumulation rates are presented which indicate that grasslands have inherent mechanisms to adjust to grazing pressure. Net primary production is similar on grazed and ungrazed grasslands, but the predominant pathways vary. System transfer functions indicate that under grazing pressure, productivity of grasslands belowground is more important relative to aboveground productivity. Values for efficiency of energy capture indicate similar results for both grazed and ungrazed grassland.

SS10,125-132 Williams, G. J. III. 1971. Producer function on the Intensive and Comprehensive Sites, p. 125-132. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep. Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Respiration, Photosynthesis, Plant respiration, Soil respiration, Carbon dioxide exchange, Buffalo grass, Blue grama, Western wheatgrass, Plant growth, Growth analysis, Interception, Growth rate, Energy flow, Solar radiation, Net radiation, Reflectivity, C-3 pathway, C-4 pathway, Osage

The IBP study of grassland ecosystems in the United States has included an extensive study of producer function. This study has been focused on the areas of photosynthesis, respiration, translocation, and growth of grassland species. In 1970 studies it was found that sods in which *Bouteloua gracilis* predominated had CO_2 fixation rates of 652 mg/m^2/hour (corrected for dark respiration). Studies of laboratory grown seedlings of *Bouteloua gracilis*, *B. hirsuta*, *B. curtipendula*, *Andropogon saccharoides*, *A. scoparius*, *A. gerardi*, *Panicum virgatum*, and *Sorghastrum nutans* had CO_2 fixation rates that varied from 16.42 mg CO_2/g dry weight/hour to 4.71 mg CO_2/g dry weight/hour (corrected for dark respiration). These rates did not fit a pattern correlated to tall-, mid-, or shortgrass types and all eight of the species had CO_2 compensation points that placed them into the C_4 pathway. Growth temperature curves for *Bouteloua gracilis*, *Agropyron smithii*, and *Buchloe dactyloides* seedlings grown under controlled conditions coupled with data indicating the pathway type of these species indicate that pathway type (C_3-C_4) can be useful to predict the temperature growth relationship of a species. Measurements of abiotic parameters have also been useful in interpreting producer function. Sunlight interception measurements of herbage plants have been correlated with diurnal rhythms in photosynthesis as the time of lowest photosynthesis is the same as least intercept of incoming radiation (midday). The data produced in 1970 have not only been useful in adding to the knowledge of producer function but have shown the advantage of integrating the research of multidisciplinary groups.

SS10,133-146 Reuss, J. O. 1971. Decomposer and nitrogen cycling investigations in the Grassland Biome, p. 133-146. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep. Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Nitrogen cycle, Microbial biomass, Microbial activity, Bacteria, Bacteria density, Bacteria biomass, Fungi, Fungi biomass, Decomposition, Decomposition cellulose, Decomposition plant, Soil respiration, Soil ATP, Pawnee, Osage, Jornada, Pantex, Ecosystem stress, Nitrogen fixation, Respiration, Microflora

Microbial numbers and biomass have been measured at the Pawnee Site, and some data are available from Comprehensive Sites. Peak bacterial numbers in the surface soil are generally in the range of 20 to 40×10^6/g, with some higher values noted at Pawnee. At the Pawnee Site fungal populations have influenced long-term grazing treatments. Higher propagule densities were found on the lightly grazed pastures, but a larger number of high frequency species were present under heavy grazing. Estimates of dry weight microbial biomass at the Pawnee Site indicate a maximum of about 100 g/m^2 to a depth of 30 cm. The substrate supply is apparently only sufficient for 5 to 10 generations of cells per year.

Decomposition of filter paper and grass material were more rapid at the more humid Osage Site than at Pawnee. However, there was no evidence for differences in inherent decomposition rate other than those due to temperature and moisture availability. Carbon dioxide evolution rates were relatively constant at the Osage Site, but at Pawnee were highly dependent on moisture supply.

Nitrogen fixation measurements by the acetylene reduction method have failed to detect significant amounts of nonsymbiotic fixation at the Pawnee Site. Native legumes are present, but the density is low, and total symbiotic fixation is small. Total biological fixation is estimated at <0.1 g/m^2 annually. The major input of fixed nitrogen is apparently that contained in rainfall. Nitrogen losses from the system appear to be small, and present data indicate that the system could be self-sustaining on the rainfall input.

SS10,147-212 Wiens, J. A. 1971. Pattern and process in grassland bird communities, p. 147-212. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep. Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Birds, Bird pattern, Bird density, Horned Lark, Cottonwood, Nesting, Bird distribution, Species diversity, Bird diversity, Species association, Jornada, Pantex, Osage, Pawnee, Bridger, Bison site, Migration, Bird migration, Bird population, Bird biomass, Intersite comparison, Habitat, Bird habitat, Grazing influence, Grasshopper Sparrow, Feeding habit, Food composition, Territorality, Lark Bunting, Dickcissel, Ingestion, Raptor, Hawk, Eagle, Golden Eagle, Owl, Predation, Breeding rate, Birth rate, Bird production, Energy flow, Bird energy flow, McCown's Longspur, Mountain Plover, Horned Lark, Meadowlark, Brewer's Sparrow, McCown's Longspur production, Brewer's Sparrow production, Mountain Plover production, Horned Lark production, Lark Bunting production, Meadowlark production, Clutch size, Reproduction, Bird reproduction, Bird energetics

Data collected during 1969 and 1970 in the U.S. IBP Grassland Biome program are synthesized to examine patterns and processes characterizing breeding bird populations and communities in grasslands with the overall intent of clarifying the role of birds as consumers in grassland ecosystems.

In analyzing pattern primary attention is given to variation in species abundances and distributions and features of avifaunal and community organization at regional, local, and within-plot scales of resolution. At the regional level patterns were generally not distinct, although low rainfall sites tended to support fewer individuals and less biomass than more mesic sites. The dominant bird species were generally widely distributed, but 70% of all species recorded were present at only one of the seven sites. Local plot-to-plot differences, associated with grazing regimes to varying degrees, were considerably more important than the regional differences. Vegetational and avifaunal relationships of plots were determined by similarity-cluster analysis and by examination of features of vegetation structure. The ranking of plots from tallgrass through shortgrass to desert was unrelated to variations in the number of breeding bird species, bird species diversity, or equitability, but standing crop biomass generally decreased along this plot gradient. Grazing had variable effects on bird populations: at some sites (Pantex) treatment plots were avifaunistically quite similar, while at others (Cottonwood) differences were considerable. At Pawnee grazing season seemed to have a greater effect than grazing intensity. Patterns of variation were much more pronounced when single species rather than breeding faunas were considered. Within sample plots, patterns of territorial overlap, territory size, habitat occupancy, and vegetational characteristics of nest sites are discussed.

Temporal variations in bird populations were also considered as patterns. Data are available only from Pawnee, but these are sufficient to demonstrate seasonal and annual alterations in species abundances.

Discussion of processes is centered upon trophic dynamics and production. Preliminary results of food habits analyses from the Comprehensive Network Sites are presented, as are more detailed summarizations of Horned Lark and Lark Bunting diets at Pawnee. The Pawnee data indicated considerable temporal variation in the proportions of seeds and arthropods in the diets of these two species, and in the consumption of prey taxa within these broad categories. Difficulties in relating these dietary data to measures of prey availability are discussed.

Information on raptors was obtained only at Pawnee. Diurnal raptors were widely dispersed, occurring at densities and standing crops substantially less than those of small passerine populations. Owls at Pawnee preyed chiefly upon small mammals and insects, but there were significant differences between the four owl species studied.

The bioenergetic demands of the breeding bird populations at Pantex, Osage, and Cottonwood are estimated from metabolic functions and information on population dynamics. The estimated energy intake of the breeding bird populations from April through August ranged from 1.01 to 2.33 kcal/m^2; thus, the energy flux through avian consumers in grasslands is apparently very small. Coupled with food habits data, these estimates suggested a general decrease in the importance of seeds as energy sources and an increase in the importance of arthropods, with a progression from shortgrass through mixed grass to tallgrass plots. Production was estimated for six treatment plots at Pawnee; values ranged from 3.6 to 6.7×10^{-3} g/m^2.

Concluding speculations compare birds and small mammals in grasslands and consider the role of birds as consumers in the dynamics of grassland ecosystems. The suggestion is offered that birds may act as controllers of other elements of system function, or may not be closely evolved into the functional framework of the ecosystem at all, existing of "excesses" in production.

SS10,213-240 Harris, L. D. 1971. A précis of small mammal studies and results in the Grassland Biome, p. 213-240. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep. Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Mammals, Rodent, Grazing influence, Rodent density, Mammal density, Jackrabbit, Jackrabbit density, Jackrabbit home range, Food composition, Dietary matrix, Ground squirrel, Grasshopper mouse, Deer mice, Kangaroo rat, Osage, Cottonwood, Dickinson, Jornada, Pawnee, Bridger, Bison site, ALE, Species diversity, Mammal diversity, Intersite comparison, Mammal metabolism, Energy flow, Mammal energy flow, Mammal production, Metabolism, Mammal energetics, Feeding habit, Food chemical composition, Digestion, Ingestion, Egestion, Homing range, Mammal metabolic rate, Metabolic rate, Lagomorph, Mammal biomass, Rodent biomass, Excretion

Three types of information are conveyed: (i) an outline of the Grassland Biome small mammal studies, (ii) exemplary results from each of the subprojects, and (iii) summary analyses and observations drawn from the entire data bank. Significant differences in rodent catches are reported for different grazing treatments, soil types, and water stress treatments, but density estimates, home range, and areas-of-occupation charts reflect no such responses for jackrabbits on the intensive site in northeastern Colorado. Bimonthly dietary analysis of six small mammal species reflect a high degree of overlap between the herbivores, but strong niche segregation in general.

Live trap and snap trap grid surveys of the small mammal communities at nine sites in the Grassland Biome reveal a maximum biomass of about 2.1 kg/ha (live weight) on a desert site to a low of 0.4 kg/ha on the northern shortgrass plains. It is tentatively concluded that the Jolly estimator is most accurate for live trap censuses. Excluding the two desert grasslands, there appears to be a direct relationship between the average summer rodent biomass and mean annual precipitation; with each centimeter increase in precipitation there is a 16 g increase in rodent biomass. Although the average number of species caught seems to be inversely related to latitude and altitude this does not hold for indices of diversity such as H'. Certain rodent communities appear to be distinctly "dominance" communities while the southern shortgrass community seems quite diverse. The dominance attribute seems to be related to vegetation diversity and rodent productivity. Similarity indices reveal that the montane and desert rodent communities do not strongly resemble the Great Plains communities. While heteromyids were found to predominate in the two desert environments, grass and geomyids predominated in the montane situations. There is a dramatic shift from carnivores constituting only 5% of the total biomass in the tallgrass to over 55% in the southern shortgrass. A simple equation for predicting energy transfer is developed, and it is concluded that an average of 1.7% of the aboveground net primary production is consumed by the Grassland Biome rodents.

SS10,241-266 Rice, R. W., J. G. Nagy, and D. G. Peden. 1971. Functional interaction of large herbivores on grasslands, p. 241-266. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep. Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Mammals, Metabolic rate, Mammal metabolic rate, Metabolism, Mammal metabolism, Bison, Cattle, Eland, Pronghorn, Antelope, Deer, Sheep, Wildebeest, Digestion, Antelope metabolism, Pronghorn metabolism, Steers, Steer metabolism, Dietary matrix, Food composition, Food chemical composition, Blue grama, Scarlet globemallow, Ingestion, Egestion, Mammal nutrition, Cattle growth, Cattle production, Mammal production, Mammal energetics, Energy flow, Mammal energy flow, Grazing travel, Energy balance, Grazing influence, Models, Mammal model, Consumer model, Antelope energy flow

The herbivore forms a link in the food chain of man by degrading plant structural carbohydrates which are not utilized directly by improvement of nutritive value of primary plant production, by the use of poor quality protein and nonprotein nitrogen for synthesis of high quality protein, and by the synthesis of the B vitamins and vitamin E. The herbivore also harvests primary production where topography or productivity precludes other harvesting methods. The herbivore also accelerates the decomposition of plant biomass.

The U.S. IBP Grassland Biome large herbivore group is studying the impact and interrelation of the pronghorn antelope, American bison, domestic cow, and sheep on grasslands. Studies to date indicate that there is a similar basal metabolic relationship among these herbivores. Their functional interaction should be described in terms other than metabolic efficiency. The American bison was shown to have a higher digestive power than domestic cattle on grassland forages; the difference was greater when mature forages were consumed. The utilization of diets by cattle was not greatly different according to grazing intensity. Summer diets had a higher nutritive value than spring or winter diets. Cattle on the heavily grazed pasture ate a larger proportion of grass, forbs, and shrubs than those on the light use pastures. Cattle gained more per head on the light use pasture whereas a total gain per hectare was greater on the heavy use pasture. Differences in cattle productivity were largely due to differences in the total intake of forage per individual animal or per pasture and on diet utilization. Antelope consumed a higher quality diet than cattle regardless of the season; cattle ate a higher proportion of grasses than antelope while antelope ate more forbs and the half-shrub fringed sagewort. The similarity of cattle and antelope diets was affected by seasons; the diets were least similar during the growing season when selection opportunity was greatest and most similar during the winter, with fewer varieties of plants available and with all plants more mature. Dietary comparisons among summer diets of antelope, bison, cattle, and sheep were made; cattle and bison ate the most similar diets, while antelope ate diets least similar to the other herbivores; sheep were intermediate between cattle, bison, and antelope in dietary habits. Preliminary observations on grazing behavior indicate that location of grazing and season are important factors influencing herbivore interaction. Preliminary optimization of primary production used by herbivores indicates that mixtures of herbivores should be more efficient secondary producers from grasslands than single species.

SS10,267-315 McDaniel, B. 1971. The role of invertebrates in the Grassland Biome, p. 267-315. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep. Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Insects, Insect checklist, Ground beetle, Bison site, Bridger, Cottonwood, Dickinson, Pawnee, Pantex, Hays, Osage, Jornada, Insect density, Ant, Spider, Collembolans, Beetle, Weevil, Leaf beetle, Ladybird beetle, Rove beetle, Antloving beetle, Scavenger beetle, Seed bug, Bug, Lace bug, Leaf bug, Stink bug, Leafhopper, Scale, Plant hopper, Aphid, Froghopper, Grasshopper, Short-horned grasshopper, Cricket, Thrips, Gall gnat, Insect biomass, Principal component analysis, Parasites, Reducers, Predation, Chewing arthropods, Sucking arthropods, Carnivore

Intraseasonal dynamics of the density of important invertebrate taxa are discussed for areas which are grazed and ungrazed by large herbivores at five sites in the U.S. IBP Grassland Biome. Ecological characteristics of the important families are discussed in relation to the 1970 intraseasonal dynamics.

Principal component analyses for density and standing crop of invertebrate families are presented. Analyses of variance of density and standing crop of invertebrate taxa and standing crops of important families and trophic levels using time-weighted means for the potential growing season are presented and discussed. From these studies 15 invertebrate taxa emerged as requiring more intensive study. These are Acarina, Araneida, Coccinellidae (Coleoptera), Scarabaeidae (Coleoptera), Tenebrionidae (Coleoptera), Entomobryidae (Collembola), Lygaeidae (Hemiptera), Miridae (Hemiptera), Tingidae (Hemiptera), Cicadellidae (Homoptera), Pseudococcidea (Homoptera), Formicidae (Hymenoptera), Acrididae (Orthoptera), Gryllidae (Orthoptera), and Thysanoptera.

SS10,317-387 Lewis, J. K. 1971. The Grassland Biome: A synthesis of structure and function, 1970, p. 317-387. *In* N. R. French [ed.] Preliminary analysis of structure and function in grasslands. Range Sci. Dep. Sci. Ser. No. 10. Colorado State Univ., Fort Collins.

Site description, Pawnee, Pantex, Dickinson, Bison site, Bridger, Jornada, Osage, Cottonwood, Hays, Latitude, Altitude, Air temperature, Growing season, Evapotranspiration, Potential evapotranspiration, Precipitation, Water storage, Moisture index, Profile development, Mean particle size, Climate, Meteorology, Microclimate, Soil water, Solar radiation, Grazing intensity, Aboveground plant biomass, Belowground plant biomass, Range condition, Intersite comparison, Primary production, Grazing influence, Principal component analysis, Litter, Insects, Insect biomass, Insect density, Insect population, Mammals, Mammal biomass, Herbivory, Cattle, Birds, Bird biomass, Food web, Reducers, Microflora, Microbial biomass, Predation, Cool grass, Warm grass, Cool forb, Warm forb, Rodent, Chewing arthropods, Sucking arthropods, Standing dead, Carnivore, Energy flow, Water efficiency, System transfer function, Consumption rate, Ingestion

The structures of the ecosystem of the Comprehensive Network Sites of the Grassland Biome study have been compared with reference to site constants, treatment variables, and 1970 state variables. The primary producer state variables studied included seasonal trends and time-weighted means of aboveground standing crop of primary producers by category and functional group, mulch, and belowground standing crop. Consumer variables studied included seasonal trends and time-weighted means of invertebrate density and standing crop by families and trophic levels and small mammal and bird standing crops by species and ecological groups. In addition, typical standing crops of domestic livestock were compared.

Relationships of the time-weighted means of primary producer state variables to site constants, driving forces, and calculated soil water were studied using stepwise multiple regression. Likewise, relationships of time-weighted means of standing crops of invertebrate trophic levels and selected families to primary producer variables as well as abiotic variables were studied using stepwise multiple regression.

The function of some ecosystems was compared with reference to the rate processes of net primary production and herbivory as affected by site constants and treatment variables.

BP67 Van Dyne, G. M. [Principal Investigator]. 1967. Analysis of structure and function of grassland ecosystems, Biome Proposal 1967. Colorado State Univ., Fort Collins.

Evapotranspiration, Runoff, Microwatersheds, Photosynthesis, Ecotype, Aboveground plant biomass, Belowground plant biomass, Plant pattern, Mammals, Ingestion, Antelope, Food composition, Nitrogen, Nitrogen fixation, Personnel vitae, Models, Modelling concept, Reptiles, Amphibian, Birds, Pronghorn, Decomposer ecology

This research project is an integral part of the United States' contribution to the International Biological Program. This research, to be coordinated especially with Canadian and Mexican studies, has two main phases. The first is the study of an entire ecosystem by a team of scientists of varying disciplines. This phase draws on the skills and resources of scientists from 10 institutions and agencies and will involve field studies on the Pawnee Site in northeastern Colorado. The second phase of the study involves scientists from another 10 institutions and agencies working in nine field locations from the Canadian to the Mexican border. The major objective of this research is to study various states of grassland ecosystems to determine the interrelationships of structure and function, to determine the variability and magnitudes of rates of energy flow and nutrient cycling, and to encompass these parameters and variables in an overall systems framework and mathematical model. A variety of scientists throughout the United States have cooperated in planning this new level of ecological research. This proposal includes a discussion of the rationale for this research and the methods for conducting and integrating the various phases of study.

PR69-0 Van Dyne, G. M. [Principal Investigator]. 1969. Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 700 p.

Models, Modelling concept

This section summarizes the progress in 1968 and outlines the rationale and objectives of the program. A preliminary model of a grassland ecosystem, which helps to define what needs to be measured and when, exposes the need of having a mechanism of exchanging information, and the possibility of grouping some studies for efficiency is also included. The needs of an intensive site study, a comprehensive program, and a cohesive program are identified.

PR69-4. Van Dyne, G. M. [Principal Investigator]. 1969. Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 700 p.

Pawnee, Computer programs, Microwatersheds, Plant checklist, CO_2 analysis system, Pronghorn, Antelope, Digestion, Ingestion, Metabolic rate, Water turnover, Mammal checklist, Bird checklist, Bird density, Lark Bunting, Nesting, Bacteria population, Owl, Food composition, Insects, Insect density, Grasshopper, Grasshopper checklist, Insect food web, Bacteria, Instrumentation, Microbial density, Microflora, Bacteria density

This section briefly summarizes some of the major results of important segments of our study through fall, 1968. Although data are still being analyzed, these reports will show the nature and extent of the studies.

Pawnee Site research, Section 4.1, is illustrated with example graphic and tabular data as well as some of the earlier computer programs which have been developed. Also included is a brief discussion of the remote sensing flight which was made in September and indications of the types of sensors used and the kinds of ground-control data obtained. This section also includes some projections for the next eight months of research and a list of expected manuscripts to be submitted for publication.

Section 4.2 is a brief summmary of the Information Synthesis Project listing the papers given to date and those projected in the two workshops.

A brief history of the Comprehensive Program planning efforts to date is given in Section 4.3; a more complete report is given in Section 8.4.

The organizational development in the Grassland Biome Program through December, 1968, is discussed in Section 4.4. Changes in the organizational structure are outlined in organizational charts for winter and summer, 1968. Some deficiencies and problems encountered within the program are briefly enumerated there as a prelude to changes planned for the coming year.

PR69-5. Van Dyne, G. M. [Principal Investigator]. 1969. Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 700 p.

Biome objectives

There are several levels and kinds of objectives in this program. There is an international level, a national level, an Analysis of Ecosystems project, and projects specifically in the Grasslands Biome Program. Kinds of objectives include those concerned with answering theoretical ecological questions, operational objectives affecting research design, and objectives which will lead to practical applications.

Three broad objectives spanning field, laboratory, and modelling studies and outlined below, are determination of driving forces, identification and measurement of ecosystem components, and evaluation of processes coupling these components and driving forces.

These three major kinds of questions and efforts are translated into a research design and strategy.

PR69-6. Van Dyne, G. M. [Principal Investigator]. 1969. Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 700 p.

Evapotranspiration, Photosynthesis, CO_2 transfer, Personnel vitae

This section discusses the planned work, organization, and sequencing of events for September, 1969, through August, 1970, for which funds are being requested in this proposal.

Section 6 illustrates our changing organizational structure with a new organizational coding scheme consistent with a PPB approach to budgeting and analysis. Another major component of this section is the presentation of the results of a preliminary PERT analysis of the overall Grasslands Biome Program effort.

A major feature of Section 6.1 is that all the major sub-sections correspond to the phases in the organizational chart. The Grasslands Biome Program has several phases, areas within phases, projects within areas, and, in some cases, sub-projects within projects.

Section 6.2 gives information on the data and sample processing and analyses and laboratory services to be offered investigators in both the Pawnee Site and Comprehensive Program studies.

Scientific coordination and information exchange remain an important task in our program. A calendar of events scheduled for the grant period is given in Section 6.3.

Systems analysis in our project includes activities in the information synthesis project, the grassland seminar, and mathematical modelling. These activities are discussed in Section 6.4 with major attention given to different conceptional approaches to mathematical modelling. A logic and philosophy of approaching modelling problems is presented. Our rationale in the modelling efforts is to define precisely and to answer the following three kinds of questions:

(1) What are the driving forces making grassland ecosystems operate?
(2) What are the components of grassland ecosystems and what are the changes in their magnitudes over time?
(3) What are the groups of processes which cause the coupling of components?

Section 6.5 enumerates plans for the Pawnee Site studies for September, 1969, through December, 1970. Plans also are keyed to the organizational chart and coding scheme developed for the program. The transition of generalized modelling concepts and philosophy to operational field plans is reviewed in Section 6.5. Most of this section, however, is concerned with a brief review of the planned studies on abiotic, producer, consumer, and the decomposer components. Aquatic studies in the grassland are discussed separately.

A prototype network study for the Comprehensive Program is developed in Section 6.7, and the concept of process studies at non-Pawnee locations is presented.

International cooperation is the focus of Section 6.9, in which a brief description is given of a planned cooperative venture between the United States and Mexico in grassland studies in Chihuahua.

PR69-8.4 Van Dyne, G. M. [Principal Investigator]. 1969. Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 700 p.

This section includes reports from the Grasslands Program which have been distributed widely.

Section 8.41 is a copy of the report resulting from the working meeting October 5-8, 1967, in Fort Collins, Colorado, at which the design of the research program for the intensive site study was developed. Also at this meeting the Biome Director was selected, and the Pawnee Site was selected for intensive site research. The report here is appended with some supplementary information on the Pawnee Site animals. The October report of the Grasslands meeting has been distributed to several hundred investigators throughout the United States, Canada, and Mexico. It has also received widespread overseas distribution. This report has been utilized, in part, in the development of the other biome programs, providing an initial pattern.

The first organizational meeting on the Comprehensive Program for the Grasslands Biome was held at Kansas State University, Manhatten, Kansas on June 27-28, 1968. A brief report of this meeting is included in section 8.42. This report was distributed to the Grasslands Biome mailing list as well as to key individuals in other biomes.

PR69-8.51 Van Dyne, G. M. 1969. Some mathematical models of grassland ecosystems, p. 497. *In* G. M. Van Dyne [Principal Investigator] Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 700 p.

Producer model

This paper outlines a diagrammatic representation of an ecosystem and a mathematical notation showing interrelationships of components within the system. The mathematical notation is developed step-by-step to build a theoretical compartment model. General matrices of differential equations describe quantitatively the simultaneous transfer of materials or energy among interrelated components within this theoretical model. Analog, digital, and hybrid analog-digital computers make possible the realistically complex models necessary for accurate descriptions of biological systems. Two studies, one dealing with intraseasonal vegetative change (herbage dynamics) and one with interseasonal change (secondary succession on old fields), illustrate applications of models. Some cautions and considerations about modelling are: (1) Successive revisions of a model in order to approach a realistic simulation are essential, and no model is perfect; (2) A model that approximates a system fairly accurately provides not merely a graphic representation, but, more importantly, a predictive instrument for manipulating a system and describing changes under natural and artificial stress; and (3) Development of realistic mathematical models of grassland ecosystems will not be trivial and will not be done by a single man, but rather, it will be a product of team effort requiring constant feedback and communication among investigators in the field, the laboratory, and the armchair.

PR69-8.52 Risser, P. G. 1969. Competitive relationships among herbaceous plants and their influence on the ecosystem function in grasslands, p. 539. *In* G. M. Van Dyne [Principal Investigator] Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 700 p.

Plant competition

The paper reviews studies on plant competition with particular reference to competitive relationships in grasslands. The success of a species depends upon several factors: seed size and number, time of germination, rate of vegetative reproduction, rate of growth, maximum number and size of individuals attained under optimum conditions, soil level at which the roots operate, time of and conditions for initiation of root and shoot growth, and allopathic considerations.

PR69-8.53 Whitman, W. C. 1969. Microclimate and its importance in grassland ecosystems, p. 607. *In* G. M. Van Dyne [Principal Investigator] Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 700 p.

Microclimate, Air temperature, Soil temperature, Wind, Atmospheric water, Evaporation, Soil water, Western wheatgrass, Transpiration, Energy balance

Microclimatic investigations in grasslands should be concerned with the abiotic environmental conditions immediately above and within the plant canopy and throughout the rooting zone in the soil. The logical boundaries of a specific microclimate depend on the nature of the plant involved and, for the mixed prairie, can be considered to extend from 5 feet above to 4 feet below the soil surface. Within these boundaries exists the effective climate within which the mixed prairie species go through their diurnal, seasonal, and life cycles. Three areas of major importance in microclimatic investigations are; the vertical gradients of temperature, water vapor, carbon dioxide and wind; the soil-water balance; and the energy balance. Previous investigations have shown that temperature gradients are the most extreme within the boundaries of microclimates, exhibiting diurnal inversion above the soil surface. Water vapor decreases with height above a grass sod. Evaporation has been shown to increase with height, as does wind speed. Little information is available for CO_2 gradients in native grass vegetation. The soil water balance which results directly from the interaction of vertical gradients and the disposition of energy in the energy balance is singly the most important factor affecting grassland productivity. Conversely, much has been done to show that standing herbage and the accumulation of litter is the most important biotic factor influencing the soil-water balance.

PR69-9. Van Dyne, G. M. [Principal Investigator]. 1969. Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 700 p.

Budget

The budget section gives details of monthly participation of individual researchers and gives costs for the total project, major phases, and so forth. Also included here is a brief discussion of some of the potential benefits of our Grasslands Biome Program research on natural resource management. The benefits, of course, are not restricted only to natural resource management, but grasslands resources are very important in the economy and well-being of man.

Our central theme is that the grasslands must be treated and understood as a whole system rather than being treated or studied segmentally. This is the key to how our proposed grassland researches in IBP can mesh with the research and management efforts of various mission-oriented federal agencies and state experimental stations.

PR70-2.4 Van Dyne, G. M. [Principal Investigator]. 1970. Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 269 p.

Producer hierarchical diagram, Consumer hierarchical diagram, Microbial hierarchical diagram, Solar radiation hierarchical diagram, Soil water hierarchical diagram

This section reviews the work done within the program in the field of systems analysis. A major achievement in the systems analysis area has been the development of a preliminary diagrammatic framework for depicting the main functional and structural aspects of ecosystems. These hierarchical diagrams for various trophic levels are given.

PR70-2.5 Van Dyne, G. M. [Principal Investigator]. 1970. Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 269 p.

Precipitation, Pawnee, Runoff, Soil water, Photosynthesis, Carbon dioxide exchange, Aboveground plant biomass, Belowground plant biomass, Soil respiration, Soil types, Soil physical characteristics, Food composition, Steers, Nesting, Birds, Insect phenology, Parasites, Respiration

This section summarizes the research conducted at the Pawnee Site. The forcing factors being considered include solar energy, air temperature, wind, and precipitation. Work on primary producers included the evaluation of biomass, and the development of an instrumentation system for measuring carbon dioxide exchange in plants growing under field conditions. Studies on litter and cellulose decomposition, microbial number, biomass, and activity are reported. Spatial distributions of plant-soil-water complexes are discussed. Studies on ruminants, small mammals and birds, mammal-plant-soil relationships, insects, reptiles, and the effect of environmental forcing functions on consumers are briefly reported.

PR70-2.6 Van Dyne, G. M. [Principal Investigator]. 1970. Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 269 p.

Site phenology, Site description

This section includes the comprehensive network progress report and deals with the planning and organization of the network studies, sampling procedures, and site characteristics.

PR70-4.1 Van Dyne, G. M. [Principal Investigator]. 1970. Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 269 p.

Models, Modelling concept

Besides providing an organizational chart of the Grassland Biome program for 1971, this section discusses the objective analysis of models and experiments. An example of a procedure for quantitatively interrelating experimental projects and mathematical modelling activities in a cost-effectiveness analysis is given.

PR70-8. Van Dyne, G. M. [Principal Investigator]. 1970. Analysis of structure and function of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 269 p.

Budget

This section includes the budget for the overall program and itemized accounting of items of special interest such as man-months participation by individual investigators, detailed equipment lists, details of other costs, man-months assignments, and dollar assignments by program phases, etc. The procedures we have used in developing the total program budget are also discussed.

PR71-2.4 Van Dyne, G. M. [Principal Investigator]. 1971. Analysis of structure, function, and utilization of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 363 p.

Models, Modelling concept, Soil water, Growth rate, Cool grass, Warm grass, Blue grama, Aboveground plant biomass, Photosynthesis, Scarlet globemallow, Prickly pear, Standing dead, Litter, Belowground plant biomass, Plant growth

The section deals with the progress in the area of systems analysis. The report includes some modelling concepts and a discussion on a low resolution model of a total grassland ecosystem. The development and experimentation with model PWNEE are described. Progress in optimization studies with an example of a nonlinear programming effort is outlined.

PR71-2.5 Van Dyne, G. M. [Principal Investigator]. 1971. Analysis of structure, function, and utilization of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 363 p.

Pawnee, Air temperature, Net radiation, Wind, Precipitation, Soil temperature, Blue grama, Growth rate, Aboveground plant biomass, Standing dead, Litter, Buffalo grass, Western wheatgrass, Leaf area index, Prickly pear, Belowground plant biomass, Reflectivity, Decomposition, Decomposition cellulose, Plant respiration, Respiration, Carbon dioxide exchange, Interception, Food composition, Jackrabbit, Lark Bunting, Horned Lark, Cottontail, Ground squirrel, Insects, Cattle, Plant growth

This section is devoted to the research conducted at the Pawnee Site. Progress in the studies on abiotic system variables, primary producers, consumers, and decomposers is briefly discussed.

PR71-2.6 Van Dyne, G. M. [Principal Investigator]. 1971. Analysis of structure, function, and utilization of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 363 p.

Intersite comparison, Aboveground plant biomass, Belowground plant biomass, Insect biomass, Insect density, Standing dead, Litter, Birds

The general types of data which were collected on the network sites during the

1970 season included: (i) the abiotic factors or driving variables, (ii) the herbage dynamics, (iii) invertebrates, (iv) small mammal populations, (v) bird populations, and (vi) decomposition. A general account and results of preliminary analyses of data in each of these groups are given. Matrices of similarity between sites have been worked out on the basis of small mammals and plant groups.

PR71-2.7 Van Dyne, G. M. [Principal Investigator]. 1971. Analysis of structure, function, and utilization of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 363 p.

Nitrogen fixation, Soil respiration, Respiration

This section reports laboratory studies on the effect of aeration, temperature, and energy supply on nitrogen fixation. Studies on microbial activity involving soil respiration measurements and dehydrogenase activity are also summarized.

PR71-4.4 Van Dyne, G. M. [Principal Investigator]. 1971. Analysis of structure, function, and utilization of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 363 p.

Simulation, Optimization

This section discusses the future systems analysis activities, with particular reference to simulation, optimization, and applications analysis. Simulation-optimization and optimization-simulation have been identified as the two major areas for concentration in 1972 and 1973.

PR71-6. Van Dyne, G. M. [Principal Investigator]. 1971. Analysis of structure, function, and utilization of grassland ecosystems: A progress report and a continuation proposal. Colorado State Univ., Fort Collins. 363 p.

Budget

This section of the proposal outlines the budget which is proposed to cover the costs of the various projects and programs presented in the foregoing sections. Since the budget for a program of this magnitde contains many individual items, only a summary discussion is presented for the various areas. The detailed aspects of the budget may be found in the computer program printouts, submitted to the granting agency, in which the budget is broken down into the individual projects and administrative units of the program. The following summary will include a brief discussion of the budget for the various program areas as described in the preceding sections of this proposal in addition to brief comments on the various budget items shown in Tables 6.1, 6.2, and 6.3. The budget items in these tables representing requests for 1972, 1973, and 1972-1973 combined, respectively, will not be discussed separately for the two years unless there is a major difference in the makeup of that particular budget item.

AR69-2510 Klein, W. M. 1969. Taxonomic support for the Grassland Biome study. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Plant checklist

Collecting forays were made on August 13, 14, and 20 and yielded 144 numbers and 117 species. Eight new genera are reported for the study area and 39 of the 117 species and subspecies were added to genera previously listed for the area. A list of fall collections is appended.

AR69-2520 Miller, L. D. 1969. The measurement of percent of functioning vegetation in grassland areas. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Reflectivity, Spectrophotometer lab

The basic light laboratory in its primary mode of operation and configuration consists of one or more spectroradiometer systems, a multipurpose data acquisition system, an X-Y plotter for visual readout, and a field trailer and power supply. The initial measurements for which the laboratory has been designed are 'in situ' measurements of reflectance (ρ) as a function of wavelength (ρ_λ) and incoming solar (H) as a function of wavelength (H_λ = irradiance). The measurement of ρ_λ will be accomplished by first measuring H_λ referenced to the $BaSO_3$ panel and then turning the instrument slightly to measure the energy reflected by the sample.

AR69-2531.1 Nunn, J. R. 1969. IBP report. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Meteorology, Lysimeter

The primary effort in the meteorology portion of IBP the last six months was the completion of a 36-channel digital recording system, design and construction of a weatherproof shelter for the housing of the recording system. Construction of the interphasing system between the magnetic tape recorder and meteorological sensors was completed. Meteorological sensors were selected, ordered and received. Design criteria and plans for a ten-foot undisturbed lysimeter were finalized.

AR69-2532.1 Bertolin, G. and J. Rasmussen. 1969. Preliminary report on the study of the climatology of the Pawnee National Grassland. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Precipitation, Air temperature

Preliminary results of a study of the climatology of the Pawnee National Grassland are presented. The spatial and time distributions and variations of precipitation are presented. A Markov Chain Probability Analysis is included in the discussion in addition to more classical statistical treatments. Some discussion of other meteorological parameters is included.

AR69-2541.1 Striffler, W. D. 1969. Hydrologic investigations. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Watershed, Bulk density, Soil physical characteristics, Soil water, Runoff, Microwatersheds

Eight microwatersheds were selected, two each under four different levels of grazing: light, medium, heavy, and no grazing. These have been instrumented to automatically measure precipitation, runoff, soil moisture, and soil temperature. The report includes data on precipitation, bulk density, soil pore space and water potential, soil moisture, runoff, and descriptions of the microwatersheds.

AR69-2542.1 Reuss, J. O. 1969. Soil nitrogen investigations. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Soil nitrogen, Nitrogen fixation

The acetylene reduction technique was used to measure rates of nitrogen fixation by free-living organisms, presumably bacteria, on soil-plant cores from the Pawnee site. At field capacity moisture levels, fixation was negligible. Slightly higher rates were observed under saturated or artificially anaerobic conditions. Rates of fixation in these systems ranged from 1 to 5 gm/hectare/day. Even the highest figure would only represent 150 gm/month. Even in the buffalo grass sod areas where water collects, the soil is not continually saturated. Also during a substantial portion of the year low temperatures severely restrict biological processes. Thus it seems unlikely that more than a few hundred grams/hectare/year are being fixed by this process, while rates on upland areas are probably even lower. Very high levels of energy-supplying material coupled with anaerobic conditions result in substantial rates, but the efficiency of conversion is low. On the whole these data indicate that free-living bacterial fixation is probably not an important source of nitrogen on the grassland.

Nodulation has not been observed on the common range legumes in the area, nor has fixation been detected by the acetylene reduction method. However, observations are limited and the data is not sufficient to draw conclusions concerning the role of symbiotic fixation.

AR69-2542.2 Franklin, W. T. 1969. Mineralogy of representative soils. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Soil movement, Soil types, Texture

This report incorporates the results of particle size fractionations of soil samples taken to characterize the mineralogy of soils at the Pawnee Site. To a large extent, the differences in the soil series examined relate to differences in the geologic parent materials. Soil samples taken from the microwatershed area were also used in studying the past and present sediment movement. Considerable alluvial and colluvial activity is indicated on the Renohill and Shingle soils. The clay content of the surface soils on the alluvial plain averages about 15% with little variation. Variation is also small for the sand and silt components.

AR69-2551.1 Moir, W. H., J. P. Boratgis, R. Sherman, and G. Paetsch. 1969. Photosynthesis of shortgrasses under field conditions. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Photosynthesis, Pawnee, Carbon dioxide exchange

Progress to September 1969 consisted mainly in developing and improving an instrumentation system for measuring carbon dioxide gas exchange in plants growing under field conditions. The observation system now includes a rigorous gas flow and temperature control.

By August 1969 major components of the photosynthesis measurement system had been tested and found satisfactory, although further improvements and modifications of some subsystem components are envisioned. The response of shortgrasses to diurnal ambient changes was measured during two weekends near the end of the growing season. Additional responses in gas exchange were measured during short periods of the active growing season, and the results are discussed.

Plans for the 1970 season include replication of photosynthesis measurements at up to six field sites, continuous diurnal observations correlated with major phenological events, measurements of soil respiration under field conditions, and measurements of the influence of plant moisture stress to carbon dioxide exchange rates.

AR69-2552.1 Uresk, D. W. and P. L. Sims. 1969. Preliminary methodology and results for above-ground herbage biomass sampling on the Pawnee Site. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Aboveground plant biomass, Standing dead

Biweekly sampling of herbage biomass including (1) standing vegetation of all species (2) standing live and dead of blue grama (*Bouteloua gracilis*) and (3) litter was conducted during the summer, 1969. Phenology data was taken on the primary species at each sampling date. The procedures of data collection are presented. The data has been submitted to the data analysis and programming section, IBP Grassland Biome, for analysis and for storage in the data bank for use by other scientists.

AR69-2552.2 Everson, A. C. 1969. Replacement of native communities with introduced communities and its impact on ecosystem function. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Community replacement, Succession

Twenty-eight plots, 50 × 50 ft, were located on each of the four selected edaphic sites: sandy plains, flood plain, plains upland, and salt meadow at the Pawnee Site. Some of these plots were ploughed and planted with crested wheatgrass, sudan grass, and blue grama, the rest were kept under native vegetation. Frequency count of species on native plots and on the stands of blue grama, crested wheatgrass, and sudan grass on the four sites was made. The experimental design and some preliminary data are included in the report.

AR69-2552.3 Porter, L. K. 1969. The mobility and translocation of nitrogen in grass plants. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Nitrogen, Plant nutrients

The report briefly reviews the literature on the mobility and translocation of nitrogen in grass plants, and outlines the procedures to be followed for the project.

AR69-2553.1 Fisser, H. G. and J. Lester. Analysis of plant pattern, distribution and relationship to environmental processes. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Prickly pear, Plant pattern, Vegetation structure

Distributional forms and dispersion characteristics of *Opuntia polyacantha* were examined in areas subjected to three grazing treatment rates (light, medium and heavy). Data were obtained from transects of 256 contiguous (Kershaw, 1957) one decimeter square quadrats in homogeneous 30 meter square study plots within each grazing treatment. This data was then subjected to an analysis of variance technique (Greig-Smith, 1952) to determine if a difference in clump size existed within and among grazing treatments. The average mean area of clump size for the light, medium and heavy grazing treatments were: 4, 16 and 128; 4 and 128; 8, 32 and 128 respectively.

AR69-2553.2 Knight, D. H. 1969. An analysis of vegetation structure on the Pawnee Grassland, with subsequent evaluations of the influence of structure on ecosystem function. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Vegetation structure, Pawnee

The objective of this IBP project is to measure those aspects of vegetation structure that are expected to be critical modifiers of energy flux, water flux, and nutrient flux in grassland ecosystems. The progress to date includes literature search on the topic, and evaluation of the methodology to be followed.

AR69-2553.3 Sherman, R. J. and B. J. Sherman. 1969. Preliminary report. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Algae

Cultures of the algal components of the soil samples collected from the Pawnee Site showed the presence of members of the genera *Anabaena*, *Cylindrospermum*, *Oedogonium*, *Nostoc*, *Cosmarium*, and *Chlamydomonas*. In addition, sterile filaments of *Chaetophora* and *Spirogyra*, as well as an unidentified unicellular green algae, were evident. Cultures of soil samples from Lake George and Linn Pond indicated an abundance of diatoms, and indicated sterile filaments of *Zygnema*, *Oedogonium*, *Spirogyra*, *Ulothrix*, *Closterium*, and *Mougeotia*.

AR69-2561.1 Hyder, D. N., K. L. Knox, and R. E. Bement. 1969. Water-soluble tracers for determining water turnover and partitioning by cattle. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Mammals, Cattle, Sheep, Rumen, Fistula, Water turnover, Urine output, Excretion

The ultimate objective of the project on water-soluble tracers for determining water turnover and partitioning by cattle, is to determine the energy and nutrient components associated with the water components consumed and excreted by cattle. For example, if fecal water output can be determined, the dry matter and energy concentrations can be expanded to total daily amounts.

In the first budget period ending October 1, 1969, ^{14}C labeled polyethylene glycol (PEG) was used to estimate fecal output, lithium (Li) was used to estimate urine output, and tritiated water (^3H_2O) was used to estimate total body water and total water turnover. Problems associated with sample collection and tracer extraction had high priority in the initial experiments.

PEG consumed in drinking water is excreted entirely in feces. However, adsorption to organic matter prevents complete recovery, and high concentrations are required for adequate sampling precision. A new extraction procedure that attains 100% recovery has been developed, and labelling with ^{14}C permits the use of very low concentrations. Since we prefer non-radioactive tracers for field studies, three non-radioactive compounds were tested as tracers of fecal output. These compounds were not satisfactory because of metabolic conversions and adsorption losses.

Li is excreted almost entirely in urine and can be used as a tracer of urine output. However, techniques for recovering Li from both urine and feces still require improvement.

Tritiated water is excreted in vapor as well as liquid phases of water, and has been used widely to determine total body water and total water turnover. Since better sampling procedures are needed, we developed equipment for collecting respired water, which requires no purification, and compared respired water with that obtained from saliva, blood, and urine. Tritium concentrations were the same in all water sources Therefore, field sampling can be designed to accommodate the equipment available and the objectives of a study.

In the second budget period, we propose to estimate urine and fecal outputs of cattle on pastures stocked heavily (23E) and lightly (23W), as well as to continue studies on the development of water-soluble tracers. In 1969, Dr. Rice measured fecal output of fistulated steers by total collection. Fecal output by the heifers used to apply the grazing routines was not measured. Urine output was not measured for any animal. Therefore, using water soluble tracers to estimate urine and fecal outputs can make the work of Dr. Rice easier and the overall determination of cattle bioenergetics more complete. The work in 1970 will determine sampling precision and accuracy, if the radioactive tracers are given safety clearance.

AR69-2561.2 Rice, R. W. and D. R. Cundy. 1969. A comparison of the esophageal or rumen grab sampling for the botanical and chemical determination of grazing sheep. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Mammals, Sheep, Rumen, Food composition, Digestion, Mammal nutrition, Sheep nutrition, Nitrogen

Rumen samples had a significantly higher proportion of grass species than esophageal samples. Conversely, there was a significantly lower proportion of forbs and shrubs present in rumen samples. A seasonal trend showing a differential rate of rumen digestion of plant species was exhibited. The nitrogen content of esophageal samples was less than of rumen samples for all but the earliest sampling date. The esophageal samples were always higher in *in vitro* digestibility than rumen samples. It is concluded that rumen grab samples can not be expected to represent dietary nitrogen or digestibility trends in grazing animals.

AR69-2561.3 Rice, R. W. and M. Vavra. 1969. Botanical species of plants eaten and intake of steers grazing light, medium and heavy use shortgrass pastures. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Ingestion, Steers, Mammal nutrition, Grazing influence, Egestion, Food composition, Fistula, Digestion, Food chemical composition

Esophageal fistulated steers were used to collect samples of grazed forage on the Pawnee Site. Grasses made up the largest proportion of diet, blue grama being the most important species. Forbs made up an overall average of approximately 40% of the diet. The diet samples from the light and heavy use pastures declined in dry matter digestibility as the season progressed. The steers grazing the medium use pasture excreted the greatest amount of fecal material while those in the heavy use pasture expelled the least. The intake of steers was influenced by the intensity of use and season.

AR69-2561.4 Nagy, J. G., K. L. Knox, and D. E. Wesley. 1969. IBP antelope project progress report. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Antelope, Energy flow, Water turnover, Metabolic rate, Mammals, Pronghorn, Excretion, Antelope excretion

Energy flow trials with four pronghorn antelope produced results similar to those described for other ruminants with the possible exception of total heat production and fasting metabolic rate. The increased heat production may have been due to the higher metabolism of young animals. The fasting metabolic rates were higher than the interspecific mean of 70 $Kcal/Kg^{3/4}/day$ (Kleiber 1961); similar results occurred with other wild ruminants.

Results obtained on water kinetics of antelope show a higher percent body water and flux in females than in males. Data also indicate that pronghorn antelope, under the conditions tested, have a slightly higher body water content than do other species examined in other studies. Since pronghorns probably have a lower body fat content than domestic animals, body water content would probably be higher. Water flux in antelope is similar to that in sheep or deer.

AR69-2562 Hansen, R. M., J. T. Flinders and B. R. Cavender. 1969. Diets and energy relations of jackrabbits at the Pawnee Site. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Jackrabbit, Jackrabbit biomass, Age structure, Sex ratio, Food composition, Pawnee

An exhaustive review of literature on the food habits of North American hares indicated the following.

Members of the genus *Lepus* are very widely distributed throughout North America. They occur in almost every habitat, ranging from the arid desert regions of the southwest to the cold tundra regions. Ten species of this genus naturally occur in North America and one species has been introduced.

Arctic and Alaskan hares are typical of the tundra areas in the far north. Dwarf willows and birches are apparently the main foods of Arctic hares.

Snowshoe hares occupy the boreal forests, extending southward from the tundra regions to New Mexico. They feed upon woody plants in the winter and upon the more succulent forbs and grasses at other seasons of the year. Aspen, willows, birch, alder, spruce, and fir are the most common woody plants eaten by snowshoes. These hares are of concern to foresters because they do extensive damage to forest plantations of white pine, red pine, jack pine, and white spruce. The snowshoes exert beneficial influences on forests by thinning overcrowded stands. Competition between moose and snowshoes, in Newfoundland, occurs only on cutover areas where balsam fir is the dominant browse plant.

Jackrabbits occur in open regions of the western portions of the United States and Mexico. They prefer green succulent plants during spring and summer but depend upon shrubs for food during winter. The species of plants eaten varies throughout the range and largely depends on the species of plants that are available. Jackrabbits often damage crops and trees in cultivated areas when food becomes scarce on the native range.

Jackrabbits have been considered indicators of poor range condition when their population densities have occurred concurrently with heavy livestock use. However, there are no data to show that jackrabbit densities decrease on such ranges when livestock pressure is decreased. Because jackrabbits generally prefer forbs to grasses and forbs are generally considered weeds on cattle ranges, the influence of the jackrabbits in some cases may actually be beneficial. However, there is no data to substantiate this supposition. The population density of jackrabbits should be considered an expression of the habitat preferences and the available food supply for jackrabbits rather than an indicator of some previous abuse of the rangeland. (Hansen, R. M. and J. T. Flinders. 1969. Food habits of North American hares. Range Science Series No. 1. Colorado State Univ., Fort Collins.)

The dietary composition was evaluated by microscopic examination of stomach contents of jackrabbits sampled at the Pawnee Site. A summary listing is made for all plant species that occurred at the kill sites. The sex ratio in black-tailed jackrabbits was 100 males to 99.34 females and in white-tailed jackrabbits 100 males to 100.6 females. Data on age structure and suckling period were also collected. The method for the preparation of microscope slides is also appended.

AR69-2562.1 Hansen, R. M. and J. C. Free. 1969. Relative dry weight estimates in diets of herbivores by the microscope method. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Food composition, Pawnee, Jackrabbit, Ground squirrel, Mammals

Regression equations that express the relationship between estimated percentage of dry weight and actual percentage of dry weight for grasses, forbs, and grass-forb combinations in the diets of herbivores were developed. The abundance of thirteen-lined ground squirrels and northern grasshopper mice was recorded.

AR69-2562.3 Flake, L. D. 1969. A study of rodents in northeastern Colorado. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Rodent, Pawnee, Mammals, Mammal density, Rodent density, Rodent biomass, Mammal biomass

This study was primarily concerned with *Dipodomys ordii luteolus* (Goldman), *Onychomys leucogaster arcticeps* Rhoads, *Peromyscus maniculatus osgoodi* Mearns, and *Spermophilus tridecemlineatus alleni* Merriam. The results indicate that there is no relationship between grazing intensities and number of *O. leucogaster* and *S. tridecemlineatus*. Data for other species is not sufficient to warrant any conclusion.

From late spring to midsummer of 1969, *S. tridecemlineatus* represented the primary rodent biomass, while in late summer and midfall *O. leucogaster* attained this position. Both *D. ordii* and *P. maniculatus* were found in low numbers and never were the primary rodent biomass.

AR69-2562.4 Peden, D. G. 1969. Preliminary report on the progress of the bison studies. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Bison

The report briefly describes the progress in acquisition, transportation, maintenance, medical care, and training of bison.

AR69-2563.1 Creighton, P. D. 1969. Summer ecology of the Lark Bunting in north central Colorado. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Birds, Lark Bunting, Pawnee, Nesting, Predation, Food composition, Feeding habit, Energy flow, Reproduction

By looking at the characteristics of the vegetation at the nest site, some of the characteristics of nest site selection have been shown for the Lark Bunting for the shortgrass plains. In this environment a protective plant is found by each nest. Saltbrush is "used" more often in this plant and nest association than any other plant. It is associated nearly as much as are all the rest of the plants together, apparently because of greater protective value afforded by its generally dense foliage and the resulting shade and concealment. Browse type vegetation is associated with the nest in a protective role more often than grass and the annual forb types. The birds' nests were associated most often with plants from 6-11 inches in height.

The placement of nests on the lee side of the protective plant reduces impact of the physical environment.

Nest densities were highest in the class III areas (bush and grass). The class III areas were followed by class II (shortgrass) and finally by class I areas (generally taller vegetation). The nest densities were 0.125, 0.10 and 0.06 birds per acre.

The young spend less time (8-9 days) on the nest than do comparable bush and tree nesting passerines (10-19 days). This is indicative of the relative insecurity of nests on the ground as a whole, as compared with nests located aboveground.

Shading of the nest by an associated plant allows the highly visible, darkly colored male to participate to considerable extent in the nesting activities. The male was found to share incubation and brooding with the female.

AR69-2563.2 Ryder, R. A. 1969. Avian populations at the Pawnee Site. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Birds, Bird density, Pawnee, Horned Lark, McCown's Longspur, Meadowlark, Lark Bunting, Brewer's Sparrow, Owl, Nesting, Bird checklist, Food composition, Bird biomass, Hawk, Raptor, Eagle, Falcon, Golden Eagle

Data on the relative abundance of Horned Lark, Lark Bunting, McCown's Longspur, Western Meadowlark, Brewer's Sparrow, Mountain Plover, and other incidental birds at the Pawnee Site, arrived at by plot and roadside counts are presented. Besides, some data for grazing influence on distribution, nesting density, production, biomass, and chronological fluctuations in populations are also given.

Comparative feeding ecology of four species of owls in north-central Colorado, and a census of diurnal raptors for hawks, eagles, and falcons are also included in the report.

AR69-2564.1 Van Horn, D. 1969. Report on orthoptera research at the Pawnee Site during 1969. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Insects, Insect checklist, Insect density, Insect phenology

Data are presented for the annual population dynamics of 32 species of orthopteroid insects on pastures of various grazing intensities on the Pawnee National Grasslands in Weld County, Colorado.

The results of quantitative sampling from October 1968 to November 1969 suggest that there are two peaks of adult grasshopper populations during a calendar year. The first peak occurs in May and early June with three acridid grasshoppers as the major species. The second peak occurs in September and October. This second peak is substantially larger than the earlier one and involves at least six acridid species as the main contributors to density and biomass. One species in particular is very abundant. This is *Melanoplus gladstoni* which had a peak adult density in October 1968 of 7.67 per 10 square meters and 3.4 per 10 square meters in September 1969. Weather probably has a very important influence on density dynamics, but a correlation has yet to be made. Faunal composition and densities of the three pasture types are fairly similar. Thus far, data suggest that three or four species may be fairly restricted to lowland areas.

Biomass data for both sexes, juvenile instars and adults of all the species collected are now being accumulated on an oven-dry-weight basis. Data for *Melanoplus gladstoni*, *Xanthippus corallipes* and *Psolessa texana* are extant.

We have experimented with four quantitative sampling techniques. Three of those techniques are currently thought to be valid depending on time of year and the species being sampled. These are: drop-cage sampling, string frame sampling (during winter), and walk-flushing (for a few conspicuous species). The commonly used sweep-net technique is considered as being useful for qualitative sampling, but inadequate for quantitative sampling.

AR69-2564.2 Thatcher, T. O. 1969. Entomological project 7103, Grassland Biome. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Insects, Pawnee, Insect density

Data gathered during the opening phases of this project encompass the following: (i) A species census to determine what species of insects occur at the Pawnee Site. About 14,000 specimens representing 1500 to 2000 species were captured. (ii) Population trends on the aerial portions of a few plant species. Some 38 species or families of insects were recorded. (iii) Effect of insects on seeds of rangeland plants. The infestation rate, number of moth and diptera larvae per head, multispecies infestations and seed destruction for *Cirsium* are given.

AR69-2564.3 Lavigne, R. J. and L. E. Rogers. 1969. The effect of insect predators and parasites on grass feeding insects. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Predation, Ant, Parasites, Spider

This year's research resulted in the determination that there is a significant difference in the distribution of the western harvester ant and in the proportional distribution of the predatory families under investigation.

A predator-prey matrix was set up for the robber flies showing the order of prey that they select (Table 10). Prey records of the other predatory families are too sparce to permit much in the way of analysis at this time.

A preliminary food web was established for the Pawnee site (Figure 1).

Additional investigations being conducted as a result of this research consists of laboratory experiments on the food habits of wolf spiders and tiger beetles. Western harvester ant colonies are also being excavated to obtain population and biomass estimates.

AR69-2571.1 Lloyd, J. E. 1969. Soil macro-arthropod species and their distribution and abundance in the Grassland Biome. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Soil fauna, Pawnee

At biweekly intervals soil samples will be collected from the study site and returned to Laramie for extraction of arthropods. Soil samples will be taken from a regular grid design so that distribution pattern can be determined. At time of sampling data on soil conditions such as moisture, temperature and soil type and surface vegetation will be determined. Initial collections will determine for later samples the most efficient number of samples.

AR69-2572.1 Doxtader, K. G. 1969. Microbial biomass measurements at the Pawnee Site: Preliminary methodology and results. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Soil respiration, Bacteria, Bacteria density, Bacteria biomass, Fungi, Fungi biomass, Soil ATP, Bacteria population, Respiration, Microflora, Microbial density, Microbial biomass, Microbial population

Twenty-six different isolates were recognized in cultures of bacteria from phyllosphere-litter component at the Pawnee Site. The biomass of both bacteria and fungi, as determined by direct estimation procedure, declined with soil depth. A chemical technique using ATP assay is being developed for the estimation of microbial biomass in the soil.

AR69-2572.2 Mayeux, J. V. and E. A. Jones. 1969. Bacterial ecology of Pawnee grassland soils. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Bacteria, Bacteria density, Bacteria population, Microbial density, Microbial population

The plate count technique revealed that the general distribution of microbial population at the Pawnee Site decreased with depth and that the major change in numbers occurred below a depth of 45 cm.

AR69-2572.3 Clark, F. 1969. Proposal for a cellulose decomposition study at the Pawnee Site. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Decomposition, Decomposition cellulose

A cellulose decomposition study is proposed to study the rate of cellulose decomposition in the upper root zone profile, to correlate this rate with meteorological data, and to evaluate the influence of added mineral nutrients on the cellulose-decomposer activity.

AR69-2581-2582 LaVelle, J. W., J. A. Seilheimer, N. L. Osborn, and S. J. Herrmann. 1969. A preliminary study of lentic communities on the Pawnee National Grasslands. U.S. IBP Grassland Biome Annual Report. Colorado State Univ., Fort Collins.

Pawnee, Ponds, Pond physical characteristics, Pond chemical characteristics

Literature was reviewed on primary productivity of grassland lentic communities. Studies of this nature are very limited in number and apparently lacking for the Colorado, Wyoming, and Nebraska area. Instrumentation was developed to measure and record diurnal oxygen changes in grassland ponds. Four shallow water bodies on the Pawnee Grasslands were surveyed: Cottonwood Pond, Spring Pond, Lake George, and Lynn Lake. The surface areas for the first three were 0.4, 0.3, and 20.2 hectares respectively. All ponds, with the exception of Lynn Lake, had a mean depth of approximately .5 meter. Biological and chemical sampling was done at monthly intervals on each pond beginning in September, 1968 and extending through September, 1969. This preliminary survey showed each pond to be highly unique in its chemical and biological characteristics. The four ponds, however, represent types which occur commonly in the grassland biome.

OL001 Nagy, J. G., T. A. Barber, and A. E. McChesney. 1969. *Clostridium perfringens* enterotoxemia in hand reared antelope. J. Wildlife Manage. 33:1032-1033.

Pronghorn, Antelope, Parasites, Mortality

Enterotoxemia caused by *Clostridium perfringens* was responsible for the death of a 2-month-old hand-reared antelope (*Antilocapra americana*). This case of enterotoxemia and other digestive upsets occurred as a group of antelope fawns began to consume solid food along with their milk diet. Symptoms of the disease and preventive treatment given to the animals is discussed.

OL002 Moir, W. H. 1968. Prairie rebirth. Science 162:1312.

Symposia report

In a symposium on prairie and prairie restoration at Knox College, Illinois, 14-15 September 1968, a group of scientists and prairie enthusiasts gathered to compare notes on how to recreate prairie communities before their otherwise inevitable extinction. Twelve of the papers given at the symposium were concerned with the nature of prairie environments. Influence of wild or controlled fire, and soil environment received excellent symposium coverage. Ten papers were concerned with the techniques of restoration. The paper summarizes the proceedings of the symposium.

OL003 Free, J. C., R. M. Hansen, and P. L. Sims. 1970. Estimating dry weights of food plants in feces of herbivores. J. Range Manage. 23:300-302.

Food composition, Fistula, Steers, Cattle, Mammals, Sheep

The dry weight composition of foodplants was estimated by a microscope technique for esophageal samples from steers, fecal samples of steers and fecal samples from sheep fed on the esophageal samples. Perennial species of foodplants forming more than 5% of the diets could be identified and quantified by the analysis of 100 microscope fields at 125 power magnification. The diagnostic features of fragile forbs were not as prominent in feces as they are in non-digested plants.

OL004 Jameson, D. A. 1970. Value of broom snakeweed as a range condition indicator. J. Range Manage. 23:302-304.

Plant cover, Succession, Cover

Following an initial 13 year stabilization period, changes in broom snakeweed populations on southwestern pinyon-juniper ranges were investigated over a subsequent 13-year period. The changes which occurred appeared to be the result of oscillating populations rather than of range condition.

OL005 Clarke, F. E. and E. A. Paul. 1970. The microflora of grassland. Advance. Agron. 22:375-435.

Microflora, Rhizosphere, Decomposition, Decomposition litter, Litter decomposition, Actinomycetes, Bacteria, Fungi, Algae, Lichens, Microbial biomass, Microbial activity, Soil biochemistry, Exudate, Nitrogen fixation, Nitrification

The role of microscopically small organisms in numerous soil processes, particularly those affecting plant productivity, is well recognized. Less well known is a quantity of recently gathered information concerning microorganisms as components of major plant communities and the extent to which they participate in the total energy flow therein. Macfadyan (1963) has calculated that, of ecosystem gross productivity, roughly 14% is respired by higher plants, 28% is consumed by herbivores, and 56% is metabolized by the decomposer organisms, namely, the soil and plant microflora and fauna. Similarly, Golley (1960) has estimated that the decomposers as a group use 70% of net production.

Although the soil microflora is the single most important group in the annual turnover of energy trapped by photosynthesis, to the authors' knowledge no broad general review of the microflora of grassland has heretofore been compiled. Indeed this review itself achieves little more than fragmentary coverage of the existing literature on the microflora present in grassland soils or associated with either the living or dead vegetation thereon. It makes no attempt to discuss those influences on the ecosystem that the bacteria and fungi may exert in their role as causative agents of plant or animal disease. In several instances in which review discussions do exist on specific aspects of the grassland microflora, citation of such literature is used in lieu of duplicate discussion. In other instances, data are cited for nongrassland soils or communities. This may be either for comparison with similar data for grassland or, if comparable data are not available for grassland, to point up the need for such data. In the context of this review, grassland denotes any landscape which supports mainly grasses as its native vegetation or if exploited by man, is used mainly for graminous plants.

OL006 Wallace, J. D. and G. M. Van Dyne. 1970. Precision of indirect methods for estimating digestibility of forage consumed by grazing cattle. J. Range Manage. 23:424-430.

Cattle, Mammals, Digestion, Steers, Sheep

Comparisons were made of the lignin ratio and the fecal nitrogen index methods of estimating digestibility of diets of grazing animals. Special attention was given to sources of error and variability in these estimates. Evaluation of indirect methods of estimating digestibility of grazed forage were made by sampling forage from the range with esophageally-fistulated steers and later feeding it to sheep in conventional digestion trials. Regression equations for predicting diet digestibility from fecal nitrogen and factors for correcting for lignin digestibility were obtained from the digestion trials with sheep. These equations and correction factors were used with composition data for fecal and forage samples from steers on the range to calculate digestibility under grazing conditions.

0L007 Wesley, D. E., K. L. Knox, and J. G. Nagy. 1969. Water kinetics in pronghorn antelope. J. Anim. Sci. 28:866-867.

Antelope, Pronghorn, Water turnover

Four pronghorn antelope, ranging from 5 to 7 mo. of age and weighing from 18.5 to 25.5 kg., were used in a study to determine their percent body water, biological half-life and water flux. Two intact males and two females were used in the experiment.

The isotope dilution technique was employed in making the determinations. Urine samples were collected twice daily, clarified, and the activity determined with a scintillation counter. The natural logarithm of the concentration for each sample, expressed as microcuries per milliliter, was plotted against the time from injection of the isotope.

The percent body water and the water flux (expressed as milliliters per day divided by the metabolic body weight) were higher for the females, while the biological half-life was higher for the males. The two males had an average percent body water of 73, a biological half-life of 5.7 days and a water flux of 195 milliliters. The two females showed an average percent body water of 82, a biological half-life of 4.5 days and a water flux of 262 milliliters.

0L008 Nunn, J. R. 1971. Engineering in ecology. Agr. Eng. 52:458-459.

Lysimeter, Instrumentation

If the current ecological crusade seeking a more harmonious coexistence of man and nature is to be successful, it must solve problems of population growth; food production for the present 3 billion people of the world with insufficient diets; pollution; increasing need for open space.

These solutions cannot be obtained entirely through individual and specialized research - they require the cooperation and coordination of interdisciplinary research teams.

IBP, a biological successor to the International Geophysical Year, was developed by the International Council of Scientific Union to run from 1966 through 1972. Over 70 countries are participating.

The grasslands is one of the 6 biomes being investigated under the Analysis of Ecosystems Integrated Research Program. The others are deciduous forest, desert, coniferous forest, tundra, and tropical forest. The grassland study site consists of 15,000 acres of the ARS, USDA Central Plains Experiment Range and 110,000 acres of the western portion of Pawnee National Grasslands operated by the United States Forest Service.

To understand the grassland ecosystem, it is essential to know the interrelationships among the system components - the physical processes of the universe cannot be separated from the biological world because the organisms of the biosphere interact with their immediate physical environment as well as one another. Analysis of the grassland ecosystems must consider the relationships between the components of energy-flux exchange at the soil atmosphere interface, soil temperature and moisture profiles, rainfall, runoff, infiltration, air temperature and wind, plus the biosphere.

Making detailed measurements of hydrometeorological parameters helps the interdisciplinary team establish appropriate relationships between the biotic and abiotic variables. A semipermanent meteorological station was designed and constructed by the Agricultural Engineering Division and the Natural Resources Research Institute's Instrumentation Group at the University.

The main objective of the Wyoming engineering group is to examine appropriate models for estimating evapotranspiration.

The final test of evapotranspiration predictions and measurements is with a lysimeter. This transducer, a large undisturbed body of soil within its own container, is placed upon an elaborate scale-load cell weighing system.

This system is recessed into the earth's crust so that the surfaces of the soil core and surrounding area are in visual, thermal and vegetative agreement. Thus it senses and records continuous changes of the soil water content. These records are used to check the validity of evapotranspiration, precipitation, and net photosynthesis prediction plus serving as a standard water loss reference for the Great Plains Area.

This lysimeter offers:

- Relatively undisturbed installation for both retainer and soil container;
- Large size: 10 ft diameter, 4 ft depth, 45,000 lb;
- An unnatural surface area due to retainer and soil container of only 1.2%; and
- High sensitivity - 0.001 in. of moisture change.

Thus this IBP program can provide a basis for accurately predicting the consequences of environmental stresses - both man-originated and natural - on the performance of biological systems. A knowledge of the interaction of all representative system components will be developed. An estimate of existing and potential plant and animal production as it relates to human welfare will be obtained for the major climatic regions of the world.

The ecological theory developed through this program can be the basis of a new and more intensive resource management, especially encompassing the problems of multiple-use optimization. Better scientific understanding of ecosystem operation will aid in evaluating and maintaining environmental quality. Thus we can expect to enhance the manpower, skills, tools and the basic theory that is essential to the management of a portion of our environmental resources.

OL009 Armijo, J. D., G. A. Twitchell, R. D. Burman, and J. R. Nunn. 1971. A large, undisturbed, weighing lysimeter for grassland studies. Amer. Soc. Agr. Eng. Paper No. 71-582. 17 p.

Lysimeter, Instrumentation

For the IBP Grassland Study, a large weighing lysimeter was completed August, 1971. Features include an undisturbed 25 ton soil core, preservation of perimeter surface conditions, sensitivity of 0.001 inches, unnatural surface area 2%, continuous and integrated recording of data. This paper describes the design, construction and performance of the lysimeter.

OL010 Bledsoe, L. J. and G. M. Van Dyne. 1971. A compartment model simulation of secondary succession, p. 479-511. *In* B. C. Patten [ed.] Systems analysis and simulation in ecology. Vol. 1. Academic Press, New York.

Models, Modelling concept, Succession, Simulation, Producer model

The current trend in environmental biology toward the use of mathematics, statistics, and computer languages for description of experimental data raises the question of whether or not these methods are at variance with the traditional methods and concepts of ecology. Is it possible to place early classical ecological studies in a quantitative framework and preserve the values therein? If so, are there advantages to be gained by a fresh look at classic data through the viewpoint of a mathematical treatment?

In an attempt to answer these questions, as well as to provide a starting point for modeling studies in an important phase of ecology, two classical studies of succession in abandoned cultivated fields (Billings, 1938; Smith, 1940) have been used to develop systems of equations which reflect the observations and conclusions of the original authors. The data which were gathered in the two studies are primarily semiquantitative in form and not of a type which readily lends itself to objective measures of "goodness-of-fit," such as minimum squared error. Nevertheless, much of the progress in modern ecology and the understanding of mechanisms of environmental biology is based upon observations and data of this type. If the techniques of systems ecology are to supplement previous findings of ecologists, they must build upon traditional techniques rather than seek to supplant them. The main objective of this chapter is to show that quantitative methods can be made to intermesh in a workable manner with qualitative statements of hypotheses. The important aspect of a quantitative model is translation of the verbally stated mechanism into mathematical form; use of empirical numerical data to test the model statistically is only one of several ways of gaining confidence in its efficacy. We hope to demonstrate that the techniques of modeling and simulation are equally applicable to situations involving nonnumerical or semiquantitative data.

A compartment model or system of ordinary, first-order differential equations has been chosen for the form of the simulation. Differential equations were used because the variables in question are basically continuous and many techniques are available for treating such systems. The equations are first order since the fundamental relations are between the time rates of change of the system variables and the state of the system. Time lag effects are considered too complex for the degree of development desired, so the use of difference equations can be avoided. The current development is without consideration of spatial variation in the dependent variables, hence the use of ordinary (nonpartial) differential equations in a "lumped parameter" system.

Intuitively, a compartment model is an abstraction of a system whose dependent variables can be thought of as describing the contents of various blocks or compartments between which a flow of material or energy, represented by interconnecting arrows, takes place. This concept is generalized to the point that we might consider using the block diagram to describe what happens when, in succession, the biomass of species A declines as that of species B increases. We are aware that no flow of organic material actually is taking place, however, the analogy is still useful in an abstract sense. The same mathematical form can be employed whether the flow is real or abstract.

OL011 Free, J. C., P. L. Sims, and R. M. Hansen. 1971. Methods of estimating dry weight composition in diets of steers. J. Anim. Sci. 32:1003-1007.

Steers, Cattle, Mammals, Food composition, Fistula

The dry weight composition of species in diets of steers grazing sandhill range in eastern Colorado was determined during 1967 by the bite-count and the microscope technique. Morning and evening diets were sampled during 3-day intervals in mid-June, late-July, early-September and mid-December. These two techniques produced similar estimates of the dry weight composition of the more important species in the diet.

Reliable estimates of the dry weight species composition of the diets of grazing steers by both methods are highly dependent upon the observer. In the case of the bite-count the observer must be able to identify individual species of plants in all growth stages at distances of up to 10 feet. The microscope procedure entails the identification of finely divided particles of esophageal fistula material by the histological characteristics of specific plants or plant parts.

Consequently, a detailed collection of plants is required to prepare reference slides for individual species and plant parts for the latter technique. The "bite-count" procedure offers advantages in that the time required to become trained is considerably less than for the "microscope" technique. The "bite-count" procedure does not require the use of esophageal fistulated animals but does require relatively gentle animals.

OL012 French, N. R., C. D. Jorgensen, M. H. Smith, and B. G. Maza. 1971. Comparison of some IBP population estimates methods for small mammals. Spec. Rep. Office Chairman, U.S. Nat. Comm., Int. Biol. Program (Austin, Texas). 25 p.

Mammals, Mammal density, Rodent, Rodent density, Field data procedures

The Standard Minimum grid is used both for livetrapping and removal trapping. Several methods of population estimation are applied to the data. Of those tested, the Jolly procedure gave best estimates based on livetrapping, and the Hansson method gave best results from removal trapping. Results are based upon a test of the procedures conducted in two large enclosures with known population densities of rodents.

OL013 Lauenroth, W. K. and W. C. Whitman. 1971. A rapid method for washing roots. J. Range Manage. 24:308-309.

Belowground plant biomass

The use of a system consisting of two sieves and pail with a spout on it greatly facilitates washing soil material from roots. Washing into the first sieve can be continued until all visible soil material is removed. The capacity of the system was 150 to 180 samples per eight-hour day. The major soil type on the sampling area was a Flasher loamy fine sand.

OL014 Lester, J. E. and H. G. Fisser. 1970. *Opuntia* clump size variation on the shortgrass plains, Pawnee Site, Nunn, Colorado. J. Colorado-Wyoming Acad. Sci. 7:37-38.

Pawnee, Plant pattern, Prickly pear, Grazing influence

Opuntia polyacantha was examined on upland sites, subjected to three grazing treatments (light, medium and heavy) for over 30 years for variations in mean area of clump size. A quantitative determination of non-randomness was established on each site by comparing the observed number of individuals per quadrat to the expected number per quadrat derived from a Poisson series. Frequency data were obtained from transects of 256 contiguous decimeter square quadrats in 30m × 30m study plots within each grazing treatment. The analysis of variance technique applied to the frequency data gave an estimate of clump sizes for each transect. Mean area of *Opuntia* clump size in each grazing treatment was determined from the consistent appearance of peaks in a set of replicate transects. Clump sizes for the light, medium and heavy grazed treatments were found at scales of: 4, 16 and 128; 4 and 128; and 8, 32 and 128 decimeters, respectively.

OL015 Nunn, J. R., R. D. Burman, L. O. Pochop, and C. F. Becker. 1971. Meteorological characteristics of heavily and lightly grazed natural grass range land. Bull. Amer. Meteorological Soc. 52(4):312. (Abstr.)

Grazing influence, Pawnee, Meteorology, Instrumentation, Air temperature, Soil water, Albedo, Net radiation, Soil temperature, Precipitation

Natural grassland pastures have been heavily and lightly grazed for over 30 yr on the Pawnee Site of the U. S. International Biological Program. The Pawnee Site is the intensive site of the Grassland Biome and is located just south of the Wyoming border near Nunn, Colo. A 36-channel meteorological data acquisition system has been operated since January 1970 with a package of 18 sensors being located over a lightly grazed pasture and the remaining 18 sensors located 1000 ft away over a heavily grazed pasture. The system was also used to compare differences in climate between an upland and bottomland site in the fall of 1970.

Incoming solar radiation, albedo, net radiation and long wave outgoing radiation are being measured. Wind velocity and direction are being logged. Air temperature at 50 and 300 cm and air humidity at the same heights are being measured. Measurements of soil temperature are being taken at each location at depths of 3, 6, 10, 20, 50 and 122 cm. All samples are continuously integrated and are simultaneously entered on magnetic tape at one-minute intervals.

Results to date indicate that albedo and net radiation are influenced by grazing management as well as location with respect to hillsides or valley bottoms. Soil temperature profiles are different and the parameters in soil temperature models are, as expected, different depending upon grazing management or location.

The paper will present information on the design and installation of the meteorological data acquisition system and typical results comparing the influence of grazing management or hillside-lowland location on meteorological parameters.

0L016 Pearson, R. L. and L. D. Miller. 1971. Design of a field spectrophotometer lab. Sci. Ser. No. 2, Dep. Watershed Sci. Colorado State Univ., Fort Collins. 102 p.

Spectrophotometer lab, Reflectivity, Computer programs, Instrumentation

The IBP Grassland Biome Program of the National Science Foundation has funded a ground based remote sensing study of the feasibility of determining the percent cover of standing green vegetation for a shortgrass prairie ecosystem by measuring the spectroreflectance of an undisturbed patch of vegetation. The equipment assembled for this study include: a spectroradiometer, with telescope viewing optics; a computer based digital data acquisition system; and calibration and logistical support systems. The determination of spectroreflectance is made by measuring with the spectroradiometer the spectroradiance reflected from a white panel painted with barium sulfate and then measuring the spectroradiance reflected from the 'in situ' sample. The ratio of these two spectroradiances at each wavelength is the spectroreflectance of the sample. Several tests have been completed which assess the suitability of the spectroradiometer for measuring spectroreflectance of various objects as well as determining percent cover of prairie vegetation.

0L017 Swartzman, G. 1971. Optimization approaches to operational grassland ecosystem management, p. 27-35. *In* M. Lillywhite and C. Martin [ed.] Environmental awareness. Second Annu. Session Inst. Environmental Sci., Proc., Colorado Chapter.

Models, Modelling concept, Optimization, Resource model

Techniques of operations research may be brought to bear in managing grazed grassland systems. Using linear, nonlinear or dynamic programming the effects of human control via grazing pressure, nutrient and irrigation treatments, and other management controls may be investigated on such management criteria as beef yield (short or long-term), total productivity (or primary productivity), erosion, range utilization, or dollar profit under a multiple use framework. The criteria of interest can be formulated into an objective function which may be maximized under the right control combination.

Alternatively, the effects of human intervention in a "natural" grassland community may be investigated with the objective function being to maximize system stability. Two kinds of stability are considered. Stability in an unperturbed system requires plant and animal density to remain approximately constant from year to year under "ordinary" environmental conditions. The other kind of stability requires the system to return to some non-null steady state within some desired time period after a large system perturbation (e.g. a large summer hailstorm or introduction of domestic herbivores).

0L018 Van Dyne, G. M. 1971. Aspects of quantitative training in the natural resource sciences, p. 440-454. *In* G. P. Patil, E. C. Pielou, and W. E. Waters [ed.] Statistical ecology, Vol. 3: Many species populations, ecosystems, and systems analysis. Pennsylvania State Univ. Press, University Park.

Models, Modelling concept

Man must manipulate the environment to produce the food, fiber, metals, and power he needs for his existence. But often he has not had adequate understanding of the long-term consequences of his manipulations. As he increasingly takes an ecological viewpoint, however, and as he increasingly uses quantitative approaches, he will be able to optimize his multiple uses of natural resources. With growing populations, and with dwindling resources, there is a critical need to assemble and activate interdisciplinary teams concerned with research and management of our natural resources and their optimal use. I am concerned here with the training procedures and philosophies to equip multidisciplinarians for these interdisciplinary teams, who have the quantitative skills to make significant contributions toward the solution of relevant resource problems.

Much must be done to reshape training programs in natural resource sciences, and some aspects of revisions and improvements are discussed here. The emphasis here concerns terrestrial ecosystems; the concepts are extendable to freshwater and marine systems. The curricula I propose below do not exist, with exception of some graduate programs approximating those outlined. The examples I show are not considered final, the best, or the only approach. But they are a point of departure.

0L019 Van Dyne, G. M., G. S. Innis, and G. L. Swartzman. 1971. Some analytical and operational approaches to developing dynamic models of ecological systems, p. 19-26. *In* M. Lillywhite and C. Martin [ed.] Environmental awareness. Second Annu. Session Inst. Environmental Sci., Proc., Colorado Chapter.

Models, Modelling concept, Simulation

The first part of this paper briefly reviews the literature of simulation models of ecological systems as contrasted with models of individual processes such as photosynthesis. It compares modelling approaches for different levels of resolution and includes studies based on Markov chains, difference equations and differential equations. The development of such large scale models requires the cooperation and coordination of scientists and technicians with widely different backgrounds and interests. The second part of this paper addresses the challenges which management faces in achieving the necessary cooperation among a group as diverse as that needed to develop ecosystem models. The existing and proposed organizational structure for accomplishing the modelling work associated with the United States' participation in the International Biological Program (IBP) will be presented.

Well-managed ecosystem modelling efforts have the potential of providing a framework for quantifying a great deal of descriptive ecology, providing a basis for the generation of an ecological theory, and eventually providing the foundation and leadership for a new level of natural resource management. These integrated programs are having a worldwide impact on developing research studies.

0L020 Wright, R. G. and G. M. Van Dyne. 1971. Comparative analytical studies of site factor equations, p. 59-95. *In* G. P. Patil, E. C. Pielou, and W. E. Waters [ed.] Statistical ecology, Vol. 3: Many species populations, ecosystems, and systems analysis. Pennsylvania State Univ. Press, University Park.

Modelling concept, Models, Producer model

This paper examines the models used for predicting forest productivity as measured by site index or tree height. These models normally take the form of multiple regression equations that relate various attributes of the site to direct measurements of productivity. A portion of the existing published equations are examined and conclusions are drawn as to the accuracy and relevance of these equations. New equations are developed and tested on original data to provide better estimates of productivity. The use of linear programming in determining the optimum site is explored and an application of this method is described. The problem of accurately recording original data is examined and the use of forms of available data to provide assessments of site productivity is covered with a case example.

0L021 Baldwin, P. H. 1970. The feeding regime of granivorous birds in shortgrass prairie of Colorado. International Biological Program, Working Group on Granivorous Birds--PT Section (Warszawa). 4(1): 26-30. (Abstr.)

Pawnee, Birds, Food composition, Lark Bunting, McCown's Sparrow, Food preference

The feeding dynamics of ground-dwelling passerine birds inhabiting the shortgrass prairie of the high plains in Colorado were investigated. The Lark Bunting (*Calamospiza melanocorys* Stej.) and McCown's Longspur (*Rhynchophanes mccownii* Lawr.) are two prominent members of this group. The kinds and amounts of foods eaten during the nesting season are interpreted in terms of trophic levels and energy flow. Food in the stomachs was partly of animal origin (62% arthropods for Lark Bunting and 78% for McCown's Longspur). The same arthropods (Acrididae, Curculionidae, Formicidae, Scarabaeidae) were eaten as major food items by both species; however, the mean length of insect was greater for buntings than for longspurs (grasshoppers 17.5 vs. 13.0 mm, and weevils 7.1 vs. 6.5 mm). The use of seeds was similar for the two birds. Both birds took most of their food from the primary consumer level, although their diet included organisms from other levels, especially producer and secondary consumer. Comparison of amounts of foods eaten with amounts available where the birds fed at ground level indicated that some foods were selected positively.

0L022 Bledsoe, L. J. and G. M. Van Dyne. 1969. Evaluation of a digital computer method for analysis of compartmental models of ecological systems. Oak Ridge Nat. Lab. (Oak Ridge, Tennessee) TM-2414. 60 p.

Models, Modelling concept, Computer programs

This report presents results of development and testing of a FORTRAN program for exploration and analysis of data from experiments in which the system may be depicted by a compartmental model. Both real and artificial data were used to check for rate and type of convergence toward the minimum sum of squares of deviations of observed from predicted data values for each compartment. Data with known degree and kind of error were generated to simulate various degrees of noise encountered in real biological data. Results of these computer studies are presented in graphic and tabular form, limitations of the program are discussed, and program and subroutine listings with directions for use are given in appendices.

0L023 Coyne, P. I. and C. W. Cook. 1970. Seasonal carbohydrate reserve cycles in eight desert range species. J. Range Manage. 23:438-445.

Plant nutrients, Phenology

Delineation of seasonal carbohydrate reserve cycles in important range plants is fundamental to development of a physiological index to proper season and intensity of range use. Carbohydrate reserves were studied with relation to growth stage of eight desert range plants in northern Utah. Most species showed definite seasonal trends. Results indicated that maximum plant vigor in relation to carbohydrate reserves depends upon reserve storage sometime at the end of the growth period.

0L024 French, N. R. 1971. Small mammal studies in the U.S. IBP Grassland Biome. Ann. Zool. Fennici 8:48-53.

Mammals, Rodent, Rodent density, Field data procedures

The Standard Minimum grid is used both for livetrapping and removal trapping. Several methods of population estimation are applied to the data. Of those tested, the Jolly procedure gave best estimates based on livetrapping and the Hansson method gave best results from removal trapping. Results are based upon a test of the procedures conducted in two large enclosures with known populations of rodents.

OL025 Hansen, R. M. and D. N. Ueckert. 1970. Dietary similarity of some primary consumers. Ecology 51:640-648.

Food composition, Insects, Grasshopper, Cricket, Dietary matrix

The dry weight composition of the diets of Richardson ground squirrels (*Citellus richardsonii*), mormon crickets (*Anabrus simplex*), and six species of grasshoppers (*Nanthippus corallipes*, *Circotettix rabula*, *Aeropedellus clavatus*, *Melanoplus infantalis*, *Melanoplus bruneri*, and *Melanoplus alpinus*), collected at Prairie Divide, Colorado, was determined. Many food plants were shared by these herbivores. Vetch (*Astragalus* spp.), sandwort (*Arenaria fendleri*), fungi, parry oatgrass (*Danthonia parryi*), bluegrass (*Poa* spp.), fringed sagebrush (*Artemisia frigida*), dandelion (*Taraxacum efficinale*), and sedge (*Carex* spp.) were major foods. Bluegrasses, vetch, and sandwort would probably become limiting if population peaks of several of these herbivores coincided. The ranking of the food niches of these herbivores from specialized to generalized based on mean indices of dietary similarities is *X. corallipes*, *A. clavatus*, *C. rabula*, *M. alpinus*, *A. simplex*, *M. bruneri*, *C. richardsonii*, and *M. infantalis*. Males ate fewer species of food plants than females of the same orthopteran species, and the diets of males and females of the same orthopteran species were occasionally less similar than were the overall diets of different species on the same date.

OL026 Hyder, D. N. and R. E. Bement. 1970. Soil physical conditions after plowing and packing of ridges. J. Range Manage. 23:289-293.

Soil physical characteristics

A system of seedbed preparation by moldboard plowing and packing small ridges appears to fulfill two requirements for successful seeding--control wind erosion and eliminate competing vegetation. The percentage by weight of soil aggregates larger than 0.833 mm increases greatly with an increase in the moisture content of soil at the time of packing. A sandy loam soil should contain 9 to 12% moisture when packed to obtain a surface condition greatly resistant to wind erosion.

OL027 Jameson, D. A. 1970. Land management policy and development of ecological concepts. J. Range Manage. 23:216-222.

Modelling concept

As ecological concepts become incorporated into the training and background information of professional land managers, they also become incorporated into land management policies. Recent developments in ecology, such as nutrient cycling studies and computer simulation of complex processes, have a favorable climate for acceptance. Possible applications should be carefully studied by land managers.

OL028 Kelly, M. J., P. Opstrup, J. S. Olson, S. I. Auerbach, and G. M. Van Dyne. 1969. Models of seasonal primary productivity in eastern Tennessee *Festuca* and *Andropogon* ecosystems. Oak Ridge Nat. Lab. (Oak Ridge, Tennessee) TM-4310. 296 p.

Models, Modelling concept, Producer model, Primary production, Aboveground plant biomass, Belowground plant biomass, Litter

Three purposes of study were: (1) to test various sampling and mathematical techniques in the analysis of grasslands typical of eastern Tennessee, (2) to explore the feasibility of increasing efficiency in future investigation, and (3) to use computer models for theoretical estimation of gross and net production and for mathematical description of transfer coefficients or functions in grasslands. Widely planted Kentucky-31 tall fescue (*Festuca elatior* var. *arundinacea* Schreb.) and the normal native old-field (or pasture) invader called "broomsedge" or "sagegrass" (*Andropogon virginicus* L.) dominated the areas studied on Clinch River terrace soils in Oak Ridge. Both communities had nearly equal annual net primary production (root plus top) but phenological cycles of dominant and minor species were quite different. Productivity estimates would have been biased on the low side without careful repeated sampling by species and/or allowance for losses of live material that occur simultaneously with growth. Present agreement between empirically and theoretically derived estimates suggests that results of both are nearly valid and complementary, but some improvements for future work are suggested.

At each sample date aboveground herbage in forty 1 m^2 plots was collected and a 0.25 m^2 sub-sample was sorted, dried and weighed. Twenty root core samples were taken from within the plots. Supplementary data on herbage mass were derived from an additional 100 unclipped plots that were measured with a capacitance meter; proportions of standing dead were visually estimated; a rank was assigned to the species according to its weight. Computer programs combining these data gave accurate estimates of the vegetation composition on a dry weight basis with a minimum of cutting and hand separating of samples. The ratio of "ranked only" plots to those clipped could be as high as 50 to 300:1 to allow for coverage of a much larger area without greatly disrupting the vegetation. Negligible differences between methods were found for species herbage biomass estimates when the vegetation was uniform, but when great variation was present the rapid-sampling method was better able to represent the irregularly distributed species. The estimation of total yield by the capacitance meter method did not detect significant differences ($P \leq 0.1$) compared with clipping for peak biomass values of the two communities. Estimated total yield values were 678 g/m^2 and 1012 g/m^2, respectively for the *Festuca* and *Andropogon* communities, as compared to the clipped values of 672 g/m^2 and 958 g/m^2 (including standing dead or attached litter as well as live material).

Positive changes in live biomass during phenologically appropriate periods were summed, giving 1001 and 892 g/m^2 as the first empirical estimates of cumulative annual oven dry organic production for *Festuca* and *Andropogon* communities. (Revisions adjusted slightly for possible sampling bias are given below.) Trends in standing (attached) dead aboveground vegetation differ: the maximum for *Festuca* (408 g/m^2) came in early summer, near time of flowering, while that for *Andropogon* (806 g/m^2) occurred just after frost killed most of the live tops. Detached litter on the ground remained low and comparatively constant: near 114 and 181 g/m^2, respectively. High apparent daily mean production rates approximated by biomass changes varied seasonally: 1.21 to 3.29 g/m^2·day (for intervals March 1 to April 27 and April 27 to May 15) for the *Festuca* community, and 1.05 to 3.34 g/m^2·day (March 10 to June 7 and June 7 to August 7) for the more mixed *Andropogon* community. Declining biomass change for later dates presumably reflected increased losses as the mass of live and dead "compartments" increased, as well as declining carbon assimilation rates.

A 7-compartment model was designed in order to simulate plausible redistribution of biomass through major parts of the system. Transfer coefficients of the final model were constant or seasonally varying and were derived from observed rates of change, plus our ancillary studies or approximations from the literature. The seasonally varying coefficients were expressed as periodic or exponential functions of arbitrary inputs that were independent of the system's state variables, and seem related to biological cycles or environmental inputs. The data were fit well by successive approximations, but problems of predicting results with the model over several years were not treated with data for one year (1967). Due to an unusually wet July, an expected summer decline in growth of the cool-season *Festuca* did not occur; both it and the warm-season *Andropogon* may have been more productive than for years of average moisture, but depth of root penetration might have been less because water tables remained high.

This study provided improved results, or suggested needs for further refinements of technique, in several aspects of grassland herbage dynamics: (1) Minimal limits on net production from biomass change in *Festuca* and *Andropogon* old-field communities appeared to be closer estimates of total community net production than most values found in the literature because (a) the sampling was sufficiently frequent to be close to peak mass for each significant taxon, (b) subsamples were separated into living and dead tops, (c) the detached (fallen) litter, and rates of input and decomposition for it were measured in a supporting study, and (d) root mass changes (ash-free) from 20 cores per collection give a means to obtain indirect estimates of mass translocation to and from root storage. (2) Estimates of some transfer rates still need to be quantified, especially losses due to animal consumption and respiration, translocation of soluble carbohydrates, and better approximations for turnover from roots. (3) Estimated rates of input to and loss from standing (attached) dead tops for the current year seem realistic, but could be refined if separate estimates for the previous year's dead tops could be made. (Many studies neglect or underestimate these transfers for both young and old dead material.) Satisfactory methods of identifying age classes and transfers for such material need further attention. (4) Input and decomposition rates for detached litter appear to be balanced so a steady-state was approximated surprisingly well; yet income and loss rates must both vary seasonally, and hence seem to be fairly well in phase with one another. For many ecosystems we should not expect such convenient balances and phasing. (5) Total live community biomass is still increasing (mostly as roots) in the young *Festuca* stand, while this total appears more nearly stabilized in the older, more mixed stand where *Andropogon* contributes only about half the aboveground production. Longer-term measurements are needed to relate slow trends to successional change (in which *Festuca* would normally be diluted by *Andropogon*, *Rubus* and more woody communities). (6) Root biomass (ash free g/m^2) in the top 20 cm of soil was much greater, and changed more seasonally, than in deeper layers: from 202 to 659 in November under *Festuca*, and from 377 to 659 (also) in late October under *Andropogon*. For 20-60 cm soil layers, roots increased from about 76 to 214 g/m^2 in July under *Festuca* and from 69 to 166 in August under *Andropogon* in 7.5 cm diameter hydraulic cores. Coefficients of variation were higher for the latter than for the 20 cm diameter cores, but the latter were practical only for 0.20 cm depths.

OL029 Marti, C. D. 1969. Some comparisons of the feeding ecology of four owls in north-central Colorado. Southwestern Natur. 14:163-170.

Birds, Owl, Food composition, Feeding habit

Four species of Owls, Great Horned (*Bubo virginianus*), Long-eared (*Asio otus*), Burrowing (*Speotyto cunicularia*), and Barn (*Tyto alba*), were selected for a study of feeding ecology. These species were chosen because it was believed data adequate to determine feeding ecology could be collected for each of them in north-central Colorado. These species occupy the secondary consumer level in the food chain, consuming a wide variety of vertebrate and invertebrate prey.

In order to determine differences and similarities which might contribute to competition for food or reduce this competition, a number of aspects will be examined. These aspects will be in the areas of physiology, morphology, and behavior. The basis for many of these comparisons will be food habits data derived from pellet analysis.

OL030 Marti, C. D. 1969. Renesting of Barn Owls and Great Horned owls. Wilson Bull. 81: 467-468.

Birds, Owl, Nesting, Reproduction, Bird reproduction

Renesting, at least in the same nest site, following an interruption of the nesting cycle apparently is unusual in owls. The Barn Owl, however, displays a very adaptable reproductive pattern and this may explain its ability to renest. A pair of Barn Owls may retain its breeding capability longer than most large raptors, and this facilitates production of second broods. It would facilitate renesting even more. The Great Horned Owl seems to be less versatile in its reproduction. In a case of renesting caused by loss of the male early in incubation, the female's hormonal control may have had time to recycle, allowing her to find a new mate and start a second brood.

0L031 Risser, P. G. 1969. Competitive relationships among herbaceous grassland plants. Bot. Rev. 35:251-283.

Plant competition

Competition among organisms may be defined as the simultaneous demands for the same resources in a common environment when these demands are in excess of the immediate supply. The resources for which competition may occur among plants are water, nutrients, light, oxygen, carbon dioxide; and during the reproduction phase, agents of pollination and dispersal. Mathematical models developed from both theoretical and experimental populations of pure and mixed species are examined in terms of the conditions for which they are valid and for the expansions which will be necessary for application to field conditions. The fragmented information now available can be united into a general model. This review of previous investigations indicates that if the seed size and number, time of germination, rate of vegetative production, rate of growth, maximum number and size of individuals attained under optimum conditions, soil level at which roots operate, time and conditions for initiation of root and shoot growth, and any allelopathic considerations are known for any given species, a reasonably good prediction can be made concerning the success of that species relative to any other for which the same information is known. The competitive relationships for a community can then be represented by a species-by-species matrix in which the elements would represent nonlinear coefficients by which the total productivity would be differentially partitioned among species under the constraints imposed by moisture, nutrients, grazing, etc.

0L032 Van Dyne, G. M. 1969. Measuring quantity and quality of the diet of large herbivores, p. 54-94. *In* F. B. Golley and H. K. Buechner [ed.] A practical guide to the study of the productivity of large herbivores. Blackwell Sci. Publ., Oxford, England.

Mammals, Cattle, Food composition

Most of the methods and information concerning the quantity and quality of the diet of large herbivores has been derived in studies with domestic animals. This review places emphasis on those studies, for they possibly provide an upper limit to the precision and accuracy attainable in studies with wild herbivores. Primary emphasis is given to studies with grazing cattle and sheep rather than to investigations in metabolism crates or in feedlot trials. Methods used solely with wild animals are discussed and compared with those used only with domestic animals. Original literature is referenced throughout this review, but special attention will be given to review papers. Coverage is not intended to be exhaustive, but instead in many instances representative studies are cited.

Study of the quantity and quality of the diet of grazing animals has three basic components. *First*, estimates must be obtained of the chemical and botanical composition of the diet. In the current review emphasis is given to stomach analysis and fistula techniques. *Second*, estimates must be made of the digestibility of the diet. Herein, both field methods and laboratory methods will be discussed. It would appear that in future studies the field and laboratory techniques could be used in a complementary, double-sampling procedure. *Third*, to estimate total herbage intake of grazing animals a measure of fecal production is required so those methods also will be considered. Throughout this review attention will be given to estimates of numbers of animals required for sampling quantity and quality of the diet, based primarily on studies with domestic animals. An appendix is provided of the derivation and interrelation of equations of interest.

0L033 Van Dyne, G. M. 1969. Implementing the ecosystem concept in training in the natural resource sciences, p. 327-367. *In* G. M. Van Dyne [ed.] The ecosystem concept in natural resource management. Academic Press Inc., New York.

Modelling concept, Resource model, Models

The preceding chapters clearly show there are many applications of ecosystem concepts in the natural resource fields. They also show that there are major differences in definitions of ecosystems and ecosystem concepts. The title of my chapter includes the terms "ecosystem," "training," and "natural resource sciences." In order to prevent ambiguity, my uses of some of these terms are defined below. Authors of several of the preceding chapters use various kinds of models to illustrate properties of ecosystems or entire ecosystems. I will inidcate how models can be used more in training in natural resource sciences. The diversity of disciplines, skills, and ideas that characterize good ecology are clearly illustrated in preceding chapters. The need for this diversity itself represents a dilemma--that of interactions which are necessary in our training and working approaches. These items are considered briefly in this section.

0L034 Van Dyne, G. M. 1970. A systems approach to grasslands, p. A131-A143. *In* 11th Inter. Grasslands Congr., Proc. Univ. Queensland Press, Australia.

Modelling concept, Models, Producer model, Ecosystem model

This paper focuses on the role of mathematical modelling and analysis in grasslands research, management, and training. Examples are given of intraseasonal and interseasonal dynamics models of herbage biomass and of a total system energetics model. A generalized, computer-compatible notation is provided for modelling ecosystems. The complexity of grassland ecosystems imposes an interdisciplinary team approach for research and management. This complexity also imposes a modelling and systems analysis approach which requires a new approach in training. We now must train many grassland scientists and managers to work in interdisciplinary teams.

0L035 Van Dyne, G. M. 1970. Systems ecology. CHIASMA 8:59-61. (Rural Sci. Undergraduates' Soc., Univ. New England, Armidale, New South Wales, Australia).

Modelling concept

An ecosystem is a system resulting from the integration of all living and nonliving factors of an environment. Application of the ecosystem concept has no limit in size and complexity. Its boundaries are delineated chiefly for convenience in study. Therefore, an ecosystem considers interrelationships between components and their environment, not one specific entity. The process of progressive succession is the recovery of a damaged ecosystem to a stable state known as the climax where energy into a system equals energy transported out. Equilibrium however, is a climax only if it is reached naturally. Intervention, i.e. by man, and maintenance of a disclimax is the essence of renewable resource management. Man is the most vital part of the ecosystems as part of and manipulator of them. His needs required that he produce a removable product for his sustenance by diverting the energy flow within a climax ecosystem. He may induce instability or encounter difficulties by trying to return an ecosystem to its native state. Systems ecology provides an answer to the understanding of long-term effects of ecosystem manipulation. This confronts the entire complexity as a whole. The conceptual medium of systems ecology is the use of models for mathematically abstracting a real world situation. Once data has been transported into mathematical models, it is then capable of being analysed by digital computers. Computers play a large role in the future of systems ecology.

0L036 Van Dyne, G. M., W. E. Frayer, and L. J. Bledsoe. 1970. Some optimization techniques and problems in the natural resource sciences, p. 95-124. *In* Society for industrial and applied mathematics. Studies in optimization I: Symposium on optimization. Philadelphia, Pennsylvania. 137 p.

Modelling concept, Optimization, Resource model

We have summarized a few of the important recent uses, and have introduced some potential needs, of optimization techniques in natural resource management sciences. These methods are just beginning to find wide application in the natural resource management fields of forestry, range management, fishery and wildlife biology, watershed management, and marine biology. There is a great potential for applying and developing sophisticated analytical techniques to these increasingly important resource problems. Analysts interested in these approaches will find increasing opportunities in contributing to the solution of natural resource problems. Such analysts are much needed in the interdisciplinary teams now being formed in research and management studies in our universities and state and federal agencies. The major conventional optimization techniques will be used to advantage in natural resource biology problems and there are special needs for developing new analytical methods and approaches to meet the characteristics of natural resource systems. Some problems are outlined for the analysts' consideration.

0L037 Vavra, M., R. W. Rice, and R. M. Hansen. 1970. Esophageal vs. fecal sampling for the botanical determination of steer diets. J. Anim. Sci. 30:1036.

Steers, Cattle, Mammals, Food composition, Fistula, Grazing influence

Esophageal fistulae and fecal samples were used to determine the botanical composition of the diets of steers grazing shortgrass range in eastern Colorado. Samples were collected in June, July and August of 1969, and January of 1970. The summer samples were drawn from 12 steers; four each on heavy, medium and light grazed pastures. The winter samples were taken from six steers; three each on heavy and light use pastures only. The esophageal fistulae and fecal samples were mixed with water in a Waring Blendor and strained on a fine mesh screen. Two microscope slides were made per sample. The occurrence of each species was determined from 20 microscope fields for each of the two slides. Ten species of grasses, 21 species of forbs, and 2 species of shrubs were observed in the samples. Statistical analysis revealed that over all seasons and pastures significant differences ($P < .05$) existed between methods for percent incidence of grasses and forbs but not for shrubs. A significant season × method interaction occurred only in the forbs. Of the principal grass species utilized, significant differences ($P < .05$) between percent occurrence due to technique were noted for *Aristida longiseta*, *Bouteloua gracilis* and *Buchloe dactyloides*, but not for *Agropyron smithii* nor for the sedge, *Carex heliophila*. Of the principal forbs consumed, differences occurred for *Cirsium undulatum*, *Kochia scoparia*, and *Eriogonum effusum*, but not for *Sphaeralcea coccinea*. *Artemisia frigida*, the only shrub consumed in any quantity did not vary in percent occurrence between methods.

0L038 Wallace, J. D. and G. M. Van Dyne. 1970. Precision of indirect methods for estimating digestibility of forage consumed by grazing cattle. J. Range Manage. 23:424-430.

Cattle, Mammals, Digestion, Sheep, Steers, Nitrogen

Comparisons were made of the lignin ratio and the fecal nitrogen index methods of estimating digestibility of diets of grazing animals. Special attention was given to sources of error and variability in these estimates. Evaluation of indirect methods of estimating digestibility of grazed forage were made by sampling forage from the range with esophageally-fistulated steers and later feeding it to sheep in conventional digestion trials. Regression equations for predicting diet digestibility from fecal nitrogen and factors for correcting for lignin digestibility were obtained from the digestion trials with sheep. These equations and correction factors were used with composition data for fecal and forage samples from steers on the range to calculate digestibility under grazing conditions.

0L039 Wesley, D. E., K. L. Knox, and J. G. Nagy. 1969. Water kinetics in pronghorn antelope. Western Sect. Amer. Soc. Anim. Sci., Proc. 20:79-82.

Pronghorn, Antelope, Water turnover

Since the pronghorn (*Antilocapra americana*) has evolved in an arid environment, certain adaptations to regulate its water metabolism may have been necessary. The insufficiency of information about the water kinetics of pronghorn must be corrected if we are to gain the physiological information to properly manage for this unique animal.

From these data it is assumed that pronghorn antelope under the conditions tested have a slightly higher body water than other animals examined in other studies. This is quite feasible due to a much lower fat content in pronghorn than most domestic or laboratory animals. The water flux are not too unlike sheep or deer. There are obvious differences existing in water kinetics of male and female pronghorn.

0L040 Wesley, D. E., K. L. Knox, and J. G. Nagy. 1970. Energy flux and water kinetics in young pronghorn antelope. J. Wildlife Manage. 34:908-912.

Pronghorn, Antelope, Water turnover, Energy flow, Pronghorn metabolism, Antelope energy flow, Mammal energy flow, Mammals, Mammal metabolism, Metabolic rate, Antelope metabolism

Energy flow trials with four pronghorn antelope (*Antilocapra americana*) ranging from 108 to 182 days of age, produced results similar to those described for other ruminants with the possible exceptions of total heat production and fasting metabolic rate. The comparatively high heat production may be related to the higher metabolism of younger animals. Fasting metabolic rates were above the interspecies mean of 70 $kcal/kg^{0.75}/24$ hours; similar results have occurred with other wild ruminants. Pronghorn antelope, under the conditions tested, had a slightly higher content of body water than reported for other ruminants. This is feasible since pronghorn probably have a lower fat content than do most domestic or laboratory animals. Water flux in antelope is similar to that in domestic sheep and mule deer (*Odocoileus hemionus*). Noticeable differences existed between water kinetics of male and female pronghorn.

0L041 Weins, J. A. 1970. Habitat heterogeneity and the structure of avian communities in grasslands. Bull. Ecol. Soc. Amer. 51(2):29. (Abstr.)

Birds, Habitat, Bird density, Bird biomass, Bird habitat, Territorality, Spatial overlap, Bird diversity, Species diversity

Avian breeding populations and habitat characteristics were measured at 15 study sites in grassland and shrubsteppe habitats in central and western United States from 1967-1969. These sites include a broad range of climatic and productivity conditions. Measures of vertical and horizontal vegetation patchiness for the study plots were related to variations in avifaunal spatial overlap. The effects of habitat patchiness on the ecology of several selected bird species were further analyzed through detailed comparisons of features of the areas occupied by the species with those of areas not utilized.