

THE BIOLOGY AND MANAGEMENT OF WILD RUMINANTS

CHAPTER THIRTEEN

PRIMARY PRODUCTION AND FORAGE FOR WILD RUMINANTS

by

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CHAPTER 13. PRIMARY PRODUCTION AND FORAGE FOR WILD RUMINANTS

Plant material synthesized as a result of photosynthesis is called primary production. The primary production available to wild ruminants is their food base, referred to as forage.

Primary production varies through the year, with the time period between killing frosts referred to as the growing season. Some primary production occurs in natural habitats before and after the killing frosts, but the major portion of plant growth occurs during the warmer weather between them.

Primary production has been given considerable attention by plant physiologists and ecologists. It has an upper limit due to water and solar energy limitations. Water may be in short supply. Solar energy is plentiful enough, but its distribution becomes limited by the plant material; canopies develop and shade the ground surface, limiting primary production there.

Primary production at the ground surface and up to heights of two to three meters becomes the forage base for wild ruminants. Forage production is very much dependent on canopy characteristics. Well-developed canopies do not allow much light to penetrate to the ground and primary production is low.

Forage is also subject to seasonal variations in quantity produced, quality of the nutrients contained, and availability to wild ruminants. Seasonal variations in forage characteristics and digestibilities were discussed in CHAPTER 11. Seasonal variations in forage consumption were discussed in CHAPTER 12. Horizontal and vertical distributions of primary production and forage are discussed in this CHAPTER 13. Uses of information on the spatial distribution of forage are made in CHAPTER 17 as part of range appraisals and again in CHAPTER 20 in calculations of carrying capacity.

Sunshine, water and carbon dioxide are the ingredients necessary for plants to produce new forms of organic matter. The total amount of organic matter synthesized as a result of photosynthesis is called the gross primary productivity. Plants respire, breaking their own organic products of photosynthesis down and distributing and assimilating the components into plant tissues having specialized functions, such as anchorage, support, absorption, reproduction, photosynthesis, and other functions. The gross primary productivity less the amount used by plants for their own respiration is the net primary productivity.

Primary production is the basis for all life. There is an upper limit to primary production because there is an upper limit to the amount of solar energy that reaches the biosphere, and to the amount that can be absorbed by plants. Primary production is also limited by the availability of nutrients and water. Interactions between these inputs--solar energy, nutrients, and water--determine the characteristics of the growing seasons. In temperate regions, annually occurring growing seasons show marked increases in primary

production early in the growing season, a leveling off later in the season, and no production during the dormant season.

The quantity or biomass of plant material present at a point in time is called the standing crop. The standing crop or biomass of annual plants at the end of a growing season can be no greater than the cumulative net primary productivity throughout the growing season, and it is usually less as early leaves wither and die and seeds are dispersed.

The standing crop of perennial plants is greater than the net annual primary productivity as biomass accumulates over the years. This biomass is generally of little or no value to wild ruminants as it becomes lignified and is quite indigestible.

Nutrients stored during the growing season--in bulbs, corms, roots, buds, and other storage organs--are used for growth and the production of photosynthetic tissue at the beginning of the next growing season when primary production begins again. After dormancy, leaf development progresses and primary production increases. Some of this primary production results in additional photosynthetic leaf tissue; a positive feedback loop resulting in accelerated production. Leaf area is an important part of this feedback mechanism, and it is sometimes used as an important parameter in the prediction of photosynthesis. The ratio of leaf area to ground surface area is called "leaf area index" and, in general, the higher the leaf area index, the higher the photosynthesis expected. Differences in leaf area indexes (LAIX) in different plant communities and changes in LAIX over time are important factors in the analyses of primary production in different habitats occupied.

Primary production may be expressed as mass per unit area and quantities for different kinds of plant communities compared. The standing crop on an area of land is the total biomass present at a point in time. The standing crop or biomass of perennial plants exceeds that of annual plants because some of the plant tissue, such as tree trunks, persists from one year to the next. Neither the standing crop nor the entire primary production are available to wild ruminants of course; only the net annual primary production within reach of the animals is part of the food resource base, and not all of that can be consumed without reducing the vigor.

REFERENCES, CHAPTER 13

PRIMARY PRODUCTION AND FORAGE FOR WILD RUMINANTS

BOOKS

TYPE	PUBL	CITY	PGES	PLCO	KEY WORDS-----	AUTHORS/EDITORS--	YEAR
aubo	mhbc	nyny	601	many	plant ecology, 2nd edition	weaver,je; clemen	1938
aubo	blak	phpa	596	defo	deciduous forests of n ame	braun,el	1950
edbo	wcbr	duio	828	many	flora of idaho	davis,rj,ed	1952
aubo	whfr	sfca	440	many	stud plant communs, 2nd ed	oosting,hg	1956
edbo	usfs	tige	174	frst	tech meas unders veg, symp	se & sw exp sta	1958
edbo	butt	loen	217	gras	measrmnt grassl prod; symp	ivins,jd,ed	1959
aubo	umpr	aami	272	defo	aspen trees, great lakes	graham,sa; harri/	1963
aubo	butt	wadc	256		quantit plant ecol, 2nd ed	greig-smith,p	1964
aubo	agso	nyny	116	many	potentl nat vegetat of u s	kuchler,aw	1964
aubo	wile	nyny	792		soil-plnt relnshps, 2nd ed	black,ca	1968
aubo	macm	nyny	653		natu, propert soil, 7th ed	buckman,ho brady	1969
edbo	ibpt	edal	256	tund	prim prod & processe; symp	intnatl biol prog	1973
aubo	mhbc	nyny	532	gras	range management, 3rd edit	stoddart,la; smi/	1975
aubo	spve	nyny	295	gras	grassland simulation model	innis,gs	1978
edbo	spve	nyny	686	tund	vegetat, prod ecol, alaska	tieszen,ll,ed	1978
edbo	spve	nyny	204	gras	perspec in grasslnd ecolog	french,nr,ed	1979

PLCO = plant community

tund = tundra

frst = forest

defo = deciduous forest

gras = grassland

many = more than one type

