

Waterfowl Carrying Capacity Assignment

WFS 340: Wetlands Ecology and Management

Description:

The goal of this assignment will be to expose you all to three common methods (i.e., constants, direct estimate, prediction) for estimating foraging carrying capacity of wetlands for waterfowl (called duck-use days, DUD). This assignment will provide an understanding of the number of waterfowl (specifically dabbling ducks) that can be sustained in a wetland or agricultural field for a given amount of time. Duck-use day estimates are used to evaluate wetland management techniques (e.g., burning versus disking) and determine management area contributions to the North American Waterfowl Management Plan sustainability objectives for states (e.g., Tennessee) and regions (e.g., Mississippi Alluvial Valley).

Requirements: 50 points (10% of final grade; **Due: 23 March 2007 by 5:00 pm**)

Each student will be required to work 5 problems on estimating waterfowl foraging carrying capacity. All work must be shown to receive full credit; however, you may use spreadsheet functions to assist in calculations. Partial credit will be given for computational but not procedural errors.

NOTE: For all problems, use daily energy requirement (DER) of waterfowl = 292 kcal/day.

Constants (10 points)

- 1) Estimate the total carrying capacity (i.e., seeds **AND** aquatic invertebrates) of the following management area using the published “constants.”

				HINT		
				<u>ha</u>	DUD _{seed}	DUD _{invert}
a)	Agricultural					
	1) Rice (harvested)	=	100			
	2) Soybean (harvested)	=	100			
	3) Rice (unharvested)	=	100			
	4) Soybean (unharvested)	=	100			
	5) Corn (unharvested)	=	100			
b)	Moist-soil wetland	=	500			
c)	Hardwood bottomlands					
	1) 30% BA red oaks	=	167			
	2) 60% BA red oaks	=	167			
	3) 100% BA red oaks	=	166			

NOTE: Use letter from Drs. Reinecke and Kaminski to the Lower MS Valley Joint Venture (for seeds) and slide handout (for invertebrates) for the above calculations. For this problem only, subtract 50 kg/ha first from grain, seed and acorn estimates. This food density is considered the threshold when waterfowl abandon sites because food resources become too sparse.

NOTE: TME units will need to be converted from kcal/g to kcal/kg, because published yields are kg/ha not g/ha. For example, average TME across several species of moist-soil plants = 2.47 kcal/g or 2470 kcal/kg. *This also may be necessary to correctly solve subsequent problems.*

→Please express answers in DUD and separately for a, b, and c. Then, comment on why differences may exist in carrying capacity among these components (i.e., a, b, and c) of the waterfowl habitat complex, particularly reflecting on yield and TME of food items. Note that acreage among components is equal (500 ha).

Direct Estimate—Seeds and Inverts (15 points)

2) Suppose you are managing a complex of 3 moist-soil wetlands at Kyker Bottoms WMA. Prior to flooding, you clip vegetation from 30 randomly placed 1-m² plots/wetland. In the lab, you learn that 3 moist-soil plants dominate most of your plots. You estimate **stem density** per species by counting number of plants/species/plot/wetland and averaging plots/species/wetland (*see stem estimates below*). In a separate sampling effort, you estimate **seed yield** per plant per species by randomly collecting 30 individuals per species per wetland, taking them to the lab, threshing seeds from their inflorescences, drying and weighing each sample, and averaging samples per species per wetland (*see seed estimates below*). Finally, you return to each wetland after flooding, sample aquatic invertebrates from 30 randomly placed 1-m² plots per wetland once per month for 3 months. You learn in the lab that 2 aquatic invertebrates dominate most of your plots among months. You estimate dry mass per species by averaging among plots and months (*see invert estimates on page 3*).

Plants:

HINT

Wetland ¹	Plant species	Stem density ²	Seed yield/plant ³
1	Barnyardgrass	5	2.8
	Fall panicum	7	2.2
	PN smartweed	13	1.7
2	Barnyardgrass	14	5.1
	Fall panicum	1	3.2
	PN smartweed	3	0.50
3	Barnyardgrass	3	0.58
	Fall panicum	14	0.09
	PN smartweed	1	0.004

g/m² kcal/m² (Mallard) kcal/m² (Blue-winged Teal)

¹Wetlands 1 = 10 ha, 2 = 5 ha, and 3 = 20 ha (**HINT:** You will need this! Recall: 1 ha = 10,000 m²).
²Average *n* plants/m²; estimated from 30 randomly located plots.
³Average dry seed mass (g)/plant; estimated from 30 randomly collected individuals.

→Estimate DUD of seeds for mallards **AND** blue-winged teal **using TMEs** presented in *Table 2* of Kaminski et al. (2003) handout then sum DUD across plant species within each wetland, and discuss why differences may exist in DUD among wetlands 1, 2 and 3 and between the 2 duck species (mallard and blue-winged teal), reflecting on wetland acreage, stem density, seed yield and TME among plant species and ducks.

Invertebrates:

Wetland ¹	Invertebrate Taxa	Average ² dry mass (g)/m ²
1	Isopoda	3.3
	Corixidae	1.2
2	Isopoda	4.8
	Corixidae	3.5
3	Isopoda	2.9
	Corixidae	2.1

¹Wetlands 1 = 10 ha, 2 = 5 ha, and 3 = 20 ha (**HINT:** You will need this! Recall: 1 ha = 10,000 m²).

²Average dry mass estimated in 30 randomly located plots among 3 months.

→ Estimate DUD per invertebrate taxa per wetland **using GE** in *Table 1* of Anderson and Smith (1998) handout (*Wetlands* publication). Then, sum DUD across wetlands but within taxa and discuss why differences may exist in DUD between the 2 invertebrate taxa.

→ Also, discuss why the difference may exist between total DUD of seed and total DUD of invertebrates, specifically relating your answer to yield (g/m²) and true metabolizable energy (kcal/g) versus gross energy (Anderson and Smith data). Kaminski et al. (2003) has a good discussion of the difference between TME and GE (full paper on class website).

Prediction (10 points)

3) Given the following morphological measurements and using Gray et al. (1999a):

Plant Species	Moist-soil Plant Morphological Measurements						
	HT	ID	IL	IV	IN	PN	FW
Fall panicum	1.25	562	1075	?	3	576	10
Barnyardgrass	0.75	240	265	?	2	52	69

→ First, estimate IV using the geometric equation for a cone given in footnote E in Table 1 of Gray et al. (1999a). Next, using the appropriate variables estimate dry seed mass (g) per plant per species using Gray et al. (1999a) equations.

→ Next, estimate total DUD of this wetland (500 ha) using above predictions of seed yield/plant, an average density of 8 plants/m² (for both species), and TME values (for mallards) in Kaminski et al. (2003).

→ If this wetland is flooded for 110 days, how many mallards per day could be potentially sustained in it on seed resources alone (i.e., invertebrate information was not provided)?

4) Given the following number of dots obscured by seed (Gray et al. 1999b): **(10 points)**

Plant Species	Dots obscured on a grid ¹
Fall panicum	382
Barnyardgrass	145
Beakrush	75
Green bristlegrass	100

¹Grid design as per Gray et al. (1999b) and Gray (1995) thesis.

→Estimate dry seed mass (g) per plant using equations in Table 1 (Gray et al. 1999b) for beakrush and green bristlegrass, and using precalculations in Table 2 (Gray et al. 1999b) for fall panicum and barnyardgrass.

→Finally, estimate total DUD of this wetland (300 ha) using above predictions of seed yield/plant, an average density of 5 plants/m² (for all species), and TME values (for mallards) in Kaminski et al. (2003). Use TME for horned beakrush for beakrush and yellow bristlegrass for green bristlegrass.

→If this wetland is flooded for 110 days, how many mallards per day could be potentially sustained in it on seed resources alone (i.e., invertebrate information was not provided)?

Direct Estimate—Acorns (5 points)

- 5) In fall 2004, we estimated dry mass (g) of acorns in the Ames Plantation bottomland. Estimates of acorn production for cherrybark, water and willow oaks were 8, 3, and 0.75 g/m², respectively. Using Table 1 in Kaminski et al. (2003), estimate the number of wood ducks that could be sustained on acorn resources alone if 75% of the bottomland was flooded for 50 days. Assume that acorn resources are accessible by wood ducks when the bottomland is flooded only. Total bottomland area at Ames = 1052 ha. Discuss the relative contributions of each oak species to wood duck use days at Ames.