Snags & Coarse Woody Debris

FOR 1001
Dr. Thom Erdle

Today's Objectives

- Snags and Coarse Woody Debris (CWD)
- What are they?
- Why are they important?
- How to measure and inventory them
- Prepare for field work

We will be sampling for snags and CWD after the field quiz on Thursday

Snags

What?

- Standing dead (dying) tree
- Sometimes defined by a minimum size

Snags

Coarse Woody Debris

What?

- Fallen dead trees and their remains
- Sometimes defined by a minimum size

Snags → *become* → Coarse Woody Debris

- **Continuum**

Death → Snag → CWD

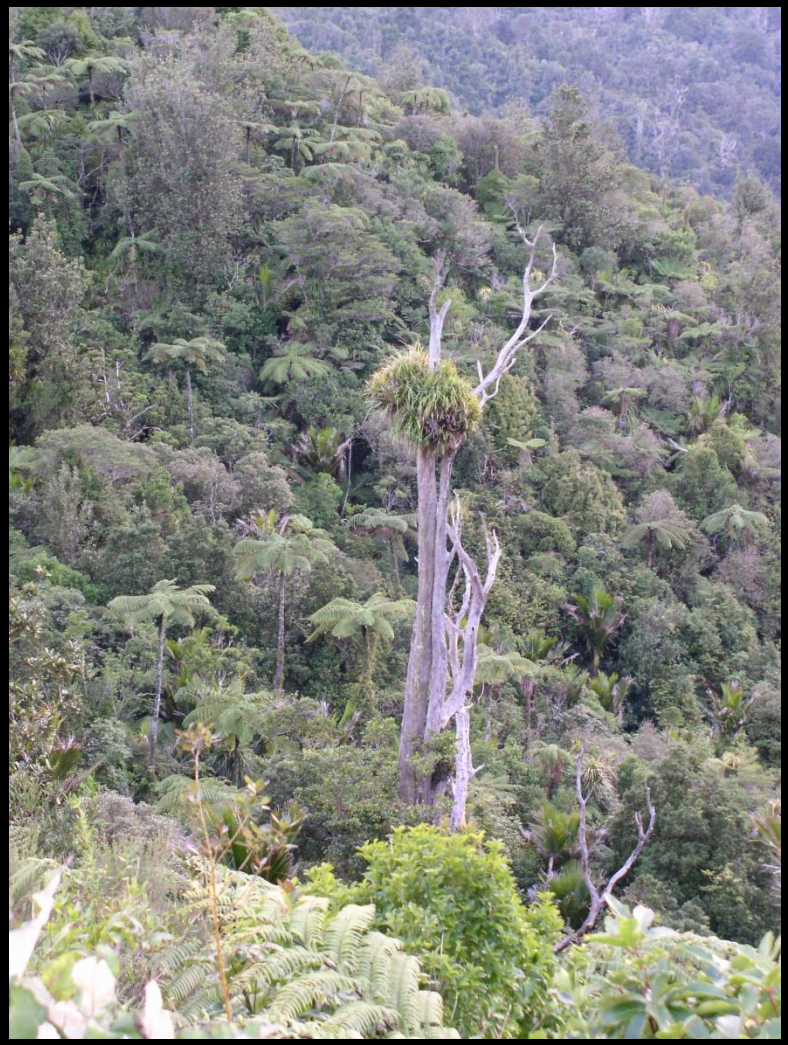
Snags & CWD

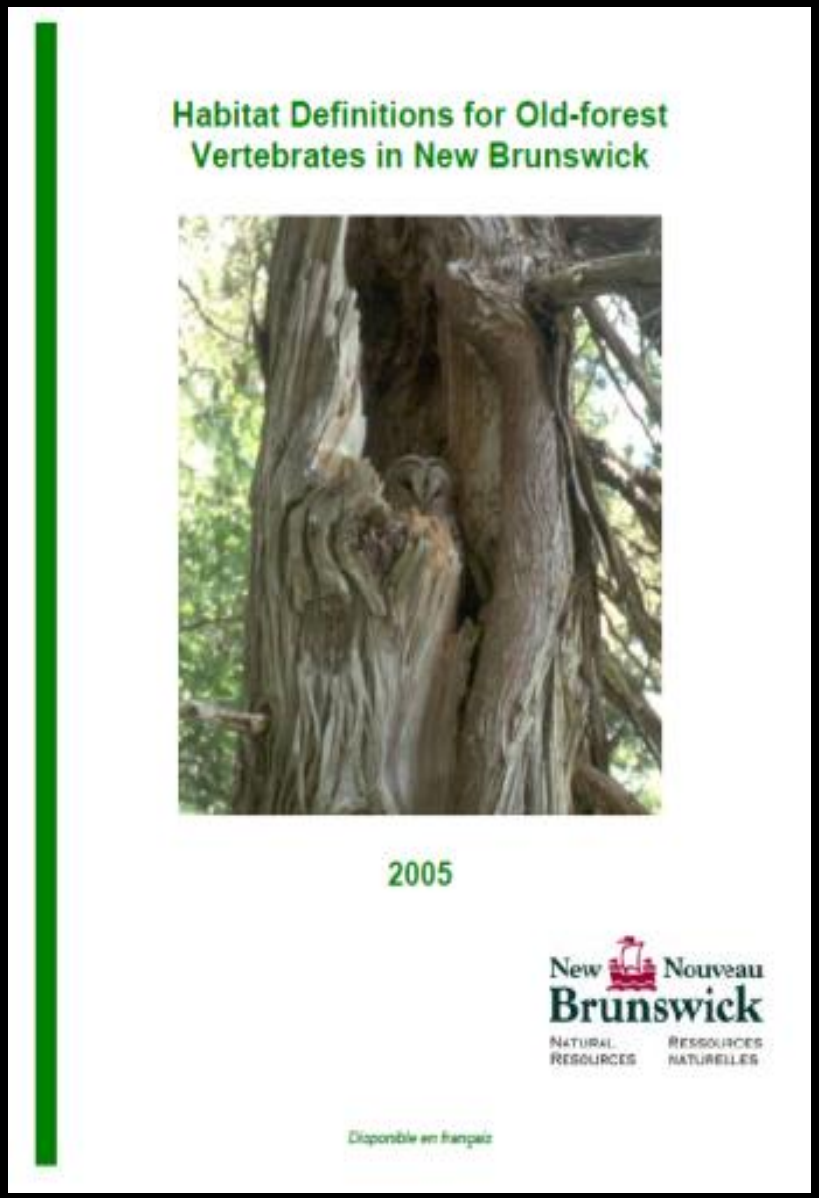
So What?

- Provide structural diversity
- Important habitats
- Source of energy for fungi & soil organisms
- Contribute to nutrient storage and cycling
- Fuel loading (fire risk & behaviour)
- Logging waste

Snags & CWD

So What?





Old Tolerant Hardwood Habitat

Old Tolerant Hardwood Habitat

- White-breasted nuthatch
- Black-throated blue warbler
- Scarlet tanager
- Eastern wood pewee
- Barred owl

Old Tolerant Hardwood Habitat

Characteristic	Value
Overstorey Stems (≥ 10 cm)	
TH Crown closure	≥ 40%
Total basal area	≥ 18 m2/ha
TH basal area	≥ 14 m2/ha
Large Stems (≥ 30 cm)	
Live trees	≥ 75/ha
Dead / dying trees	≥15/ha
Cavities	≥ 2/ha
Very Large Stems (≥ 45 cm)	
Dead / dying trees	≥ 10 per 20 ha
Cavities	≥ 5 per 20 ha

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How to Measure & Inventory

Snags

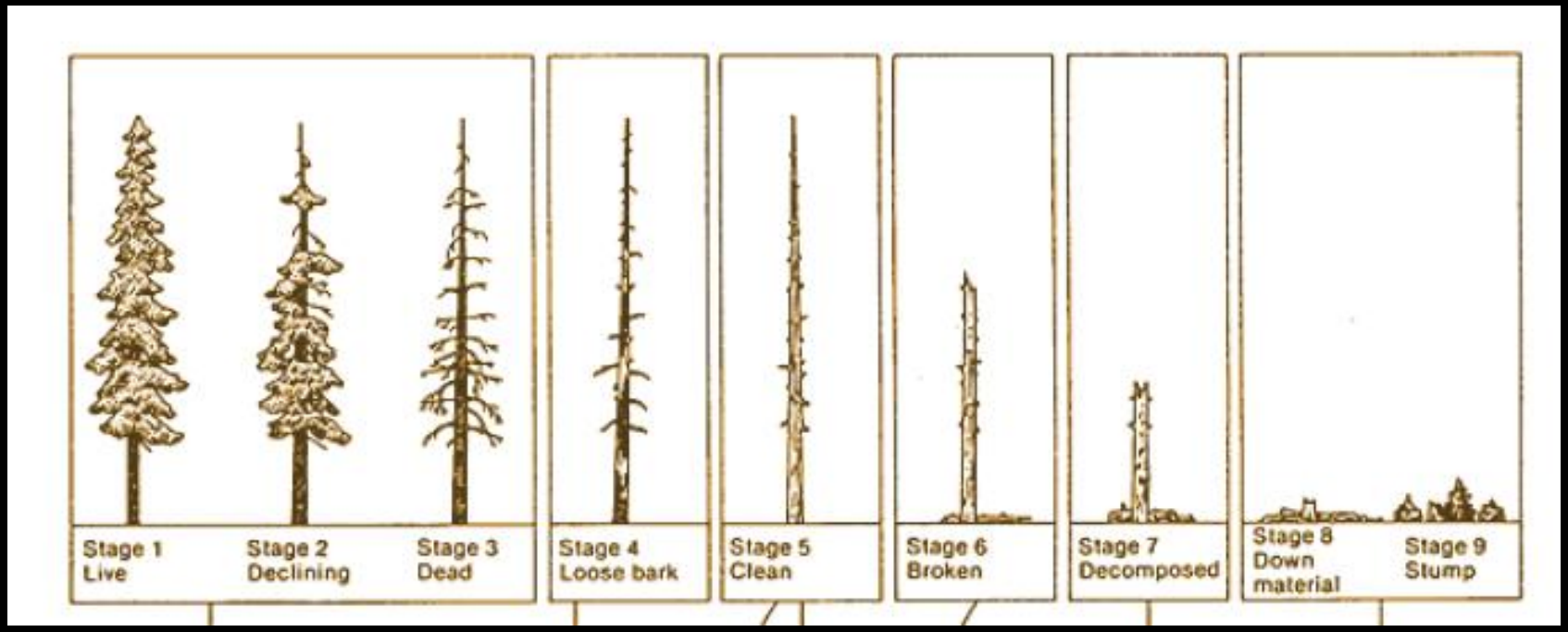
- Sampled using same methods as for live trees:
  - Fixed area plots
  - Point sampling (angle gauge or prism)
- Record trees by size (species if possible)
- Classify by state of deterioration or decay
- Various schemes are employed

How to Measure & Inventory

Snags

- Example of snag classification
- Each stage a precursor to next stage

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service



How to Measure & Inventory

Snags

- Classify by state of deterioration
- Important for what species use them and how used

Structural class 1 represents those trees that have died recently and retain most of their bark and most of their branches; the top is intact (fig. 59). Very little decay has occurred in the wood, unless the tree had heart-rot decay when it was living. Class 1 snags typically are used primarily for foraging by woodpeckers on bark beetles in and under the bark. Once the bark loosens, bats can roost and brown creepers *(Certhia americana)* can nest under the bark.

United States Department of Agriculture
Forest Service
Pacific Northwest Research Station
General Technical Report PNW-GTR-390
March 1997

Field Guide for the Identification of Snags and Logs in the Interior Columbia River Basin

Catherine G. Parks, Evelyn L. Bull, and Torolf R. Torgersen

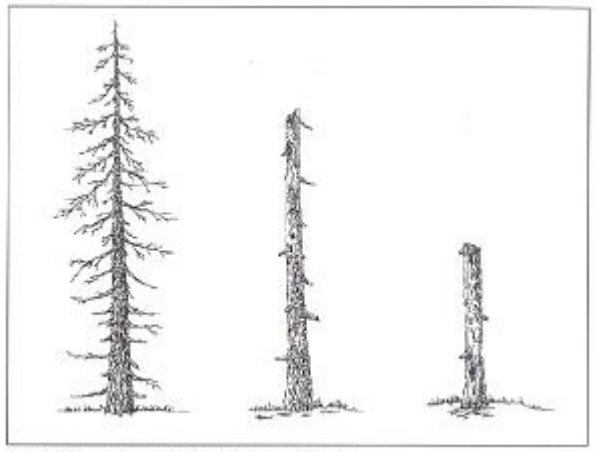


Figure 58—Three structural classes of snags.

How to Measure & Inventory

Snags

- **Structural classes**

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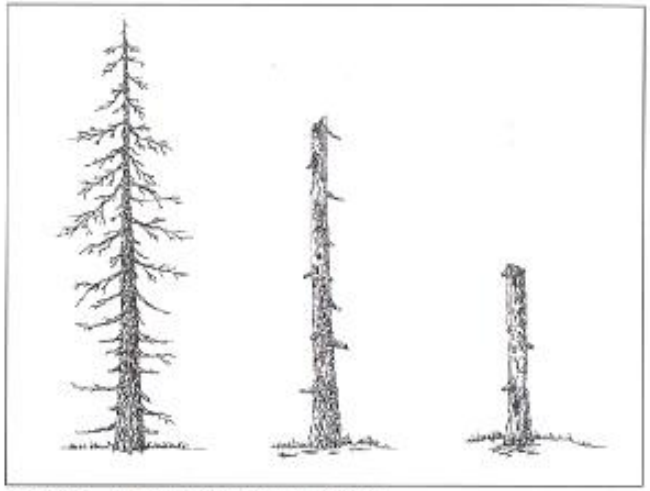


Figure 58—Three structural classes of snags.

Figure 59—Snag structural class 1.

Figure 60—Snag structural class 2.

Figure 61—Snag structural class 2.

How to Measure & Inventory

Coarse Woody Debris

- Various schemes:

Line Intersect Method

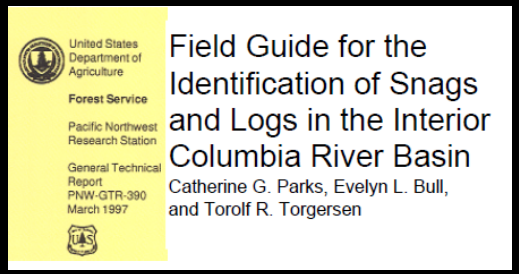
- Record pieces of CWD encountered along a transect line
- Classify by state of deterioration or decay
- Various schemes are employed

How to Measure & Inventory

CWD

- **Classify by state of deterioration**
- **Important for what species use them and how used**

Structural class 1 for logs represents those trees that have just fallen over, retain their bark and branches, have little decay in the wood, and are resting largely above the ground (fig. 64). These logs are used primarily as cover by American martens, squirrels, black bears, deer, elk, mountain lions *(Fells concolor),* and other mammals.



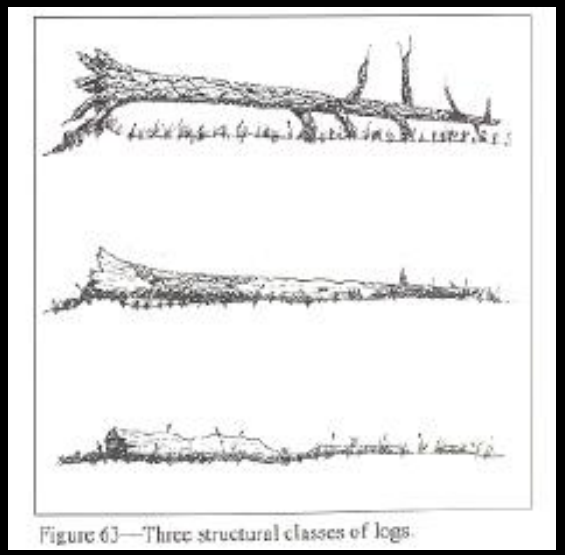


Figure 63—Three structural classes of logs.

How to Measure & Inventory

Snags

- **Structural classes**

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Figure 64—Log structural class 1.

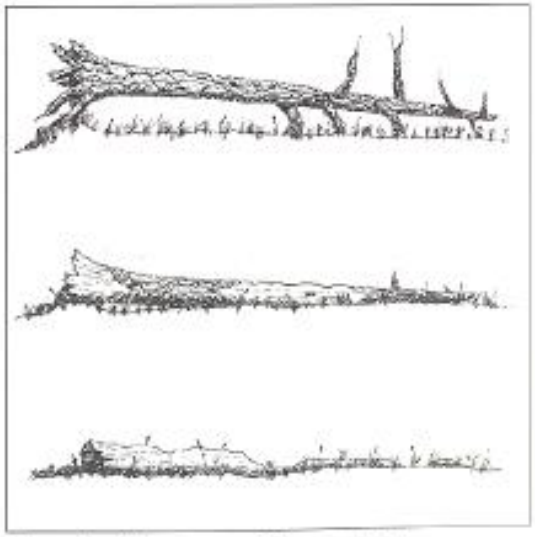


Figure 63—Three structural classes of logs.

Figure 65—Log structural class 2.

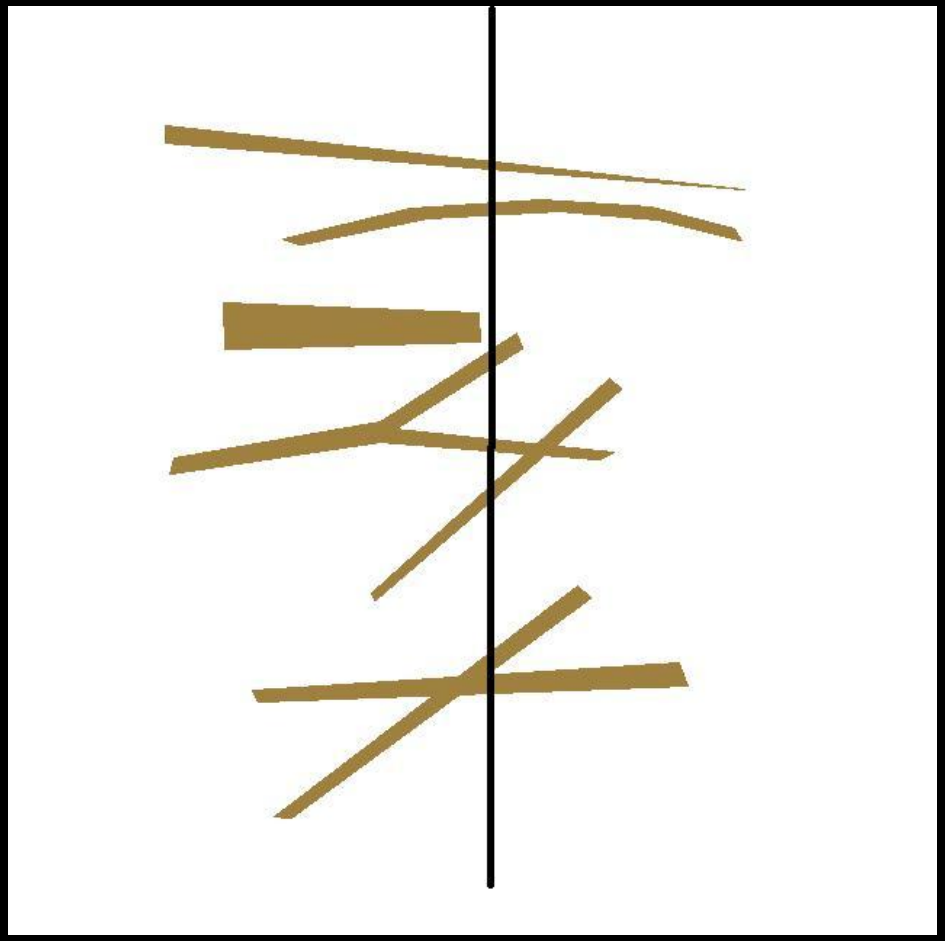
Figure 66—Log structural class 3.

How to Measure & Inventory

CWD

Line Intersect Method

- Lay out a line of given length across the area of interest
- Traverse the line being careful to stay on the initial azimuth (bearing)
- Measure and record the dimensions of each piece of woody debris that intersects the line



How to Measure & Inventory

CWD ***Line Intersect Method***

- Computation

$$\hat{T} = \frac{\pi}{2L} \sum_{i=1}^{n} \left(\frac{x_i}{l_i} \right)$$

T-hat is per unit of length squared

Where,

L = length of line (m)

l_i = length of ith piece of debris (m)

x_i = size of ith piece of debris

n = number of pieces on line

How to Measure & Inventory

CWD

Line Intersect Method

Density per square metre

- Computation

$$\hat{T} = \frac{\pi}{2L}\sum_{i=1}^{n}\left(\frac{1}{l_i}\right)$$

Where,

$L = length\ of\ \ line\ (m)$

$l_i = length\ of\ \ ith\ \ piece\ of\ \ debris\ (m)$

$x_i = size\ of\ \ ith\ \ piece\ of\ \ debris$

$n = number\ \ of\ \ \ pieces\ on\ line$

Estimating density, each piece is 1 observation

Xi = 1 for each piece of CWD

T-hat is # of pieces per m^2

How to Measure & Inventory

CWD

Line Intersect Method

Density per hectare

- Computation

Estimating density, each piece is 1 observation

Xi = 1 for each piece of CWD

Multiply by 10000 to go from m2 to ha

T-hat is # of pieces per ha

$$\hat{T} = 10000 * \frac{\pi}{2L} \sum_{i=1}^{n} \left(\frac{1}{l_i} \right)$$

Where,

$L = length\ of\ \ line\ (m)$

$l_i = length\ of\ \ ith\ \ piece\ of\ \ debris\ (m)$

$x_i = size\ of\ \ ith\ \ piece\ of\ \ debris$

$n = number\ \ of\ \ \ pieces\ on\ line$

$10000 = metres\ squared\ \ per\ ha$

How to Measure & Inventory

CWD

Line Intersect Method

Density per hectare

Example

10m transect

Length (m)	Diameter (cm)
2.4	23
7.1	15
9.3	10
11.7	8
10.7	12
10.4	15
3.3	20
11.4	13

How to Measure & Inventory

CWD

Line Intersect Method

Density per hectare

Length (m)	Diameter (cm)
2.4	23
7.1	15
9.3	10
11.7	8
10.7	12
10.4	15
3.3	20
11.4	13

Example

10m transect

$$\#/ha = \frac{10000\pi}{2*L}\sum_{i=1}^{n}\frac{1}{l_i}$$

$$= \frac{5000\pi}{10}\left(\frac{1}{2.4}+\frac{1}{7.1}+\cdots+\frac{1}{11.4}\right)$$

$$= 1571(.42+.14+.11+.08+.09+.10+.30+.09)$$

$$= 1571(.33) = 2090$$

How to Measure & Inventory

CWD

Line Intersect Method

Volume per hectare

- Computation

Estimating density, each piece is 1 observation

Xi = 1 for each piece of CWD

Multiply by 10000 to go from m2 to ha

T-hat is # of pieces per ha

$$\hat{T}/_{ha} = 10000\hat{T}$$

$$= 10000\frac{\pi^2}{80000L}\sum_{i=1}^{n} d_i^2$$

$$= \frac{\pi^2}{8L}\sum_{i=1}^{n} d_i^2$$

Where,

d_i = diameter at intersection (m)

n = number of pieces

L = transect length (m)

How to Measure & Inventory

CWD

Line Intersect Method

Volume per hectare

Example

10m transect

Length (m)	Diameter (cm)
2.4	23
7.1	15
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How to Measure & Inventory

CWD

Line Intersect Method

Length (m)	Diameter (cm)
2.4	23
7.1	15
9.3	10
11.7	8
10.7	12
10.4	15
3.3	20
11.4	13

Example

10m transect

Volume per hectare

$$\text{Volume}/\text{ha} = \frac{\pi^2}{8L}\sum_{i=1}^{n} d_i^2$$

$$= \frac{\pi^2}{8 \bullet 10}\left(23^2 + 15^2 + \cdots + 13^2\right)$$

$$= 0.1234\left(529 + 225 + 100 + 64 + 144 + 225 + 400 + 169\right)$$

$$= 0.1234\left(1856\right) = 229$$