

An Image-based Riparian Vegetation Inventory of Wyoming

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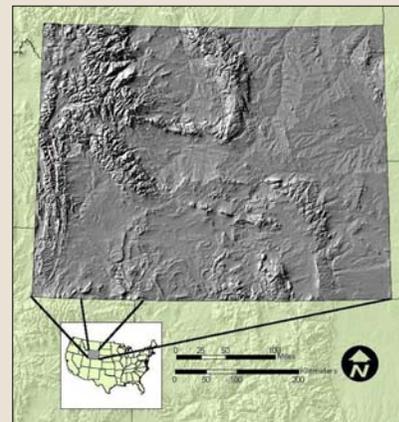


There is currently no nationally consistent method for inventorying and characterizing riparian areas. The USFS Forest Inventory and Analysis (FIA) program was not designed to inventory sparsely distributed, linear resources and, therefore, does not adequately sample riparian areas. The result is the underestimation and poor characterization of riparian resources.

The objective of this project is to develop a method of inventorying sparsely distributed lotic riparian areas using Wyoming as the study area. The method will:

- Be appropriate for inventorying large areas on the scale of states,
- Focus on estimation methods that are more cost effective than sample designs that depend entirely on ground sampling,
- Be based on imagery and other geospatial data,
- Ensure that the methods are applicable throughout the western United States and the general approach can be applied nationally,
- Recognize that inventories need to be adaptable to a hierarchy of scales, methods of analysis, and uses that will help people select the right tool for the analysis question

It is important to note that this project is not mapping of riparian areas wall-to-wall across Wyoming. Rather, the objective is to produce tabular estimates of riparian area by some spatial attribute, such as valley bottom class.



The estimation unit for this project is the entire state of Wyoming. Wyoming has a dry, semi-arid climate with elevations ranging from approximately 3000-ft in eastern Wyoming to 13,804-ft at Gannett Peak.

Multi-stage Sample Design

Inventories of natural resources frequently use a multistage sample that relies upon field sampling. These methods often achieve precise, detailed assessments; however, the extensive use of field data makes these inventories expensive and difficult to complete in a timely manner. For these reasons, this project uses a sampling design and data source that is capable of answering many of the "big picture" questions addressed by field-based inventories, but at a fraction of the cost.

The sampling concepts and tools for this project are derived from a multi-stage sampling method known as Nested Area Frame Sampling (Koeln and Kollasch 2000), which is a two-stage sampling procedure. Fundamentally, the multistage procedure being used is a three step procedure, which can conceptually be expanded to any number of sampling levels. The three steps are,

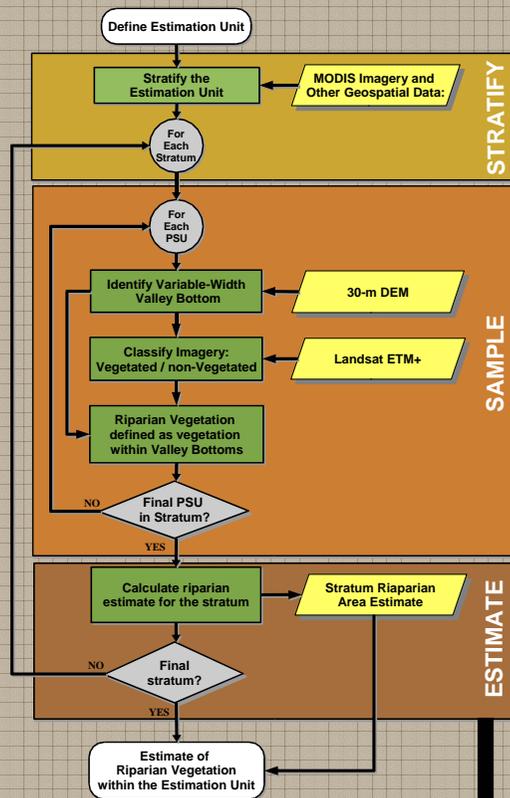
Stratify, which groups similar areas within the estimation unit for the purposes of sampling efficiency,

Sample, which is used to characterize each stratum with respect to the characteristic of interest, and

Estimate, which aggregates the information gathered into a single estimate of the characteristic for the estimation unit.

The flowchart (right) provides details on the steps being used in this project.

Citation: Koeln, Gregory T. and R. P. Kollasch (2000). *Crop Area Assessments Using Low, Moderate and High Resolution Imagery: A GeoTools Approach*. Earth Satellite Corporation, Rockville, MD. 12 p.



STRATIFY

Stratification of the estimation area was performed using a NDVI MODIS satellite imagery time series (top left), which classified the entire state based on vegetation phenological characteristics. The bottom right image shows the final strata derived from the vegetation classification.

SAMPLE

Fixed width riparian buffers or fixed dimension plots do not realistically represent complexities found in the real world. The top picture shows a river with an asymmetric riparian width.

Using a DEM, local topographic characteristics can be used to define valley bottoms. Using this method, valley bottoms are defined by elevation and distance gradients. The figure to the left shows a topographically-based drainage network (white) and valley bottom delineation (green).

Landsat imagery is used to classify vegetation. The image to the left shows healthy vegetation as red. The drainage network is also shown for reference. Intersecting the valley bottom and vegetation layers produces an estimate of riparian vegetation.

RIPARIAN ESTIMATE

The result of this process is an estimate of riparian vegetation for the state of Wyoming.

	Total Riparian (hectares)	Percent of Riparian to Total	Standard Error	Percent of Standard Error to Riparian	Total Stratum Area (hectares)	Percent of Riparian in Stratum
Stratum 1	314,325	36%	44,730	14%	12,772,806	2%
Stratum 2	77,693	9%	8,259	11%	4,359,281	2%
Stratum 3	170,311	20%	11,465	7%	1,694,963	10%
Stratum 4	299,650	35%	39,149	13%	6,029,219	5%
Stratum 5	6,302	1%	1,175	19%	386,400	2%
Wyoming	868,281	100%	104,778	12%	25,242,669	3%

Take Aways

- Remote sensing imagery and other geospatial data can be used as an effective source of information in a sample. This is in contrast to its traditional use as for mapping.
- Multi-stage sampling provides an efficient framework for using geospatial data and builds a strong foundation for further sampling.
- Details not derivable from geospatial data can be incorporated into the inventory using secondary sampling. This allows expensive field data to be used more effectively.