Forest Stewardship Spatial Analysis Project
Methodology Report for Colorado
December 2005





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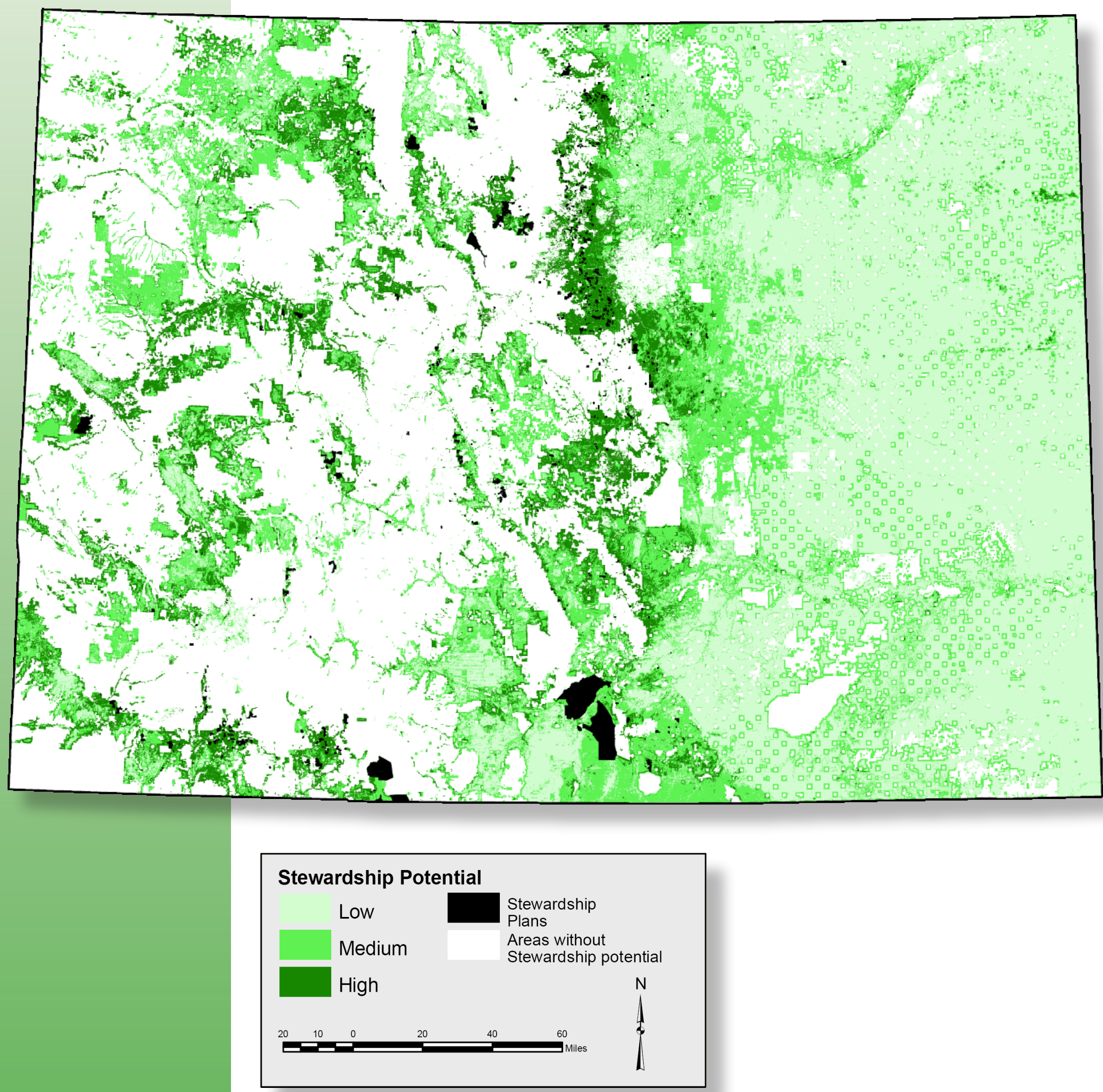


Colorado Spatial Analysis Project Results

Executive Summary:

The Forest Stewardship Program (FSP) Spatial Analysis Project (SAP) was developed to evaluate the impact over the landscape that the FSP has had over the last decade and identify areas of stewardship suitability to allow for strategic delivery of the FSP. The SAP has two main components: the historic spatial database of stewardship plan tracts, and the 12-layer suitability analysis. Both components are used together in a GIS analysis to categorize areas within a state according to the areas stewardship potential, and evaluate how effective the state has been at delivering the FSP in those priority areas.

The Colorado State Forest Service began the SAP process in June of 2004, and finished the project in January 2006. The majority of that time was committed to collecting the data for the stewardship plan database. All 17 CSFS districts were visited, and every stewardship plan evaluated, with the majority of them being digitized by hand into a geospatial database (ArcGIS personal geodatabase). In all, 872 stewardship plans were added to the database. There were 289 plans that were not added to the database because they could not readily be digitized (there was no topographic map to identify were the plan boundaries lay). Once the database was finished, work began on the suitability analysis. Completion of the analysis along with the map series and data analysis required approximately 2 months.

Analysis Results:

Stewardship Capable lands in Colorado:

- There are approximately 37.6 million acres of land in Colorado capable of being included in the Forest Stewardship Program
- Of those 37.6 million acres, approximately 9.6 million are forested
- Stewardship plan acres total 411,865 – or 1.1% of the total stewardship capable lands in Colorado.

Stewardship Potential in Colorado:

- Of the 37.6 million acres capable of stewardship, 15% is considered 'high' stewardship potential (based on 12-layer suitability analysis),
- 32% is considered 'medium' potential, and
- 53% is considered 'low' potential.

Discussion:

Stewardship potential is considered on all private lands, both forested and non-forested. With a high percentage of the forested lands in Colorado in public ownership, and a third of the state being non-forested, the total stewardship plan acres may seem low in comparison to the total area capable of stewardship. Looking at the analysis maps tells a different story. The vast majority of stewardship plans are in high and medium potential areas. This means the Colorado State Forest Service has done a good job of understanding where high priority stewardship areas are, and have focused program delivery in those high priority areas.

Stewardship Analysis Project (SAP) Introduction[1]

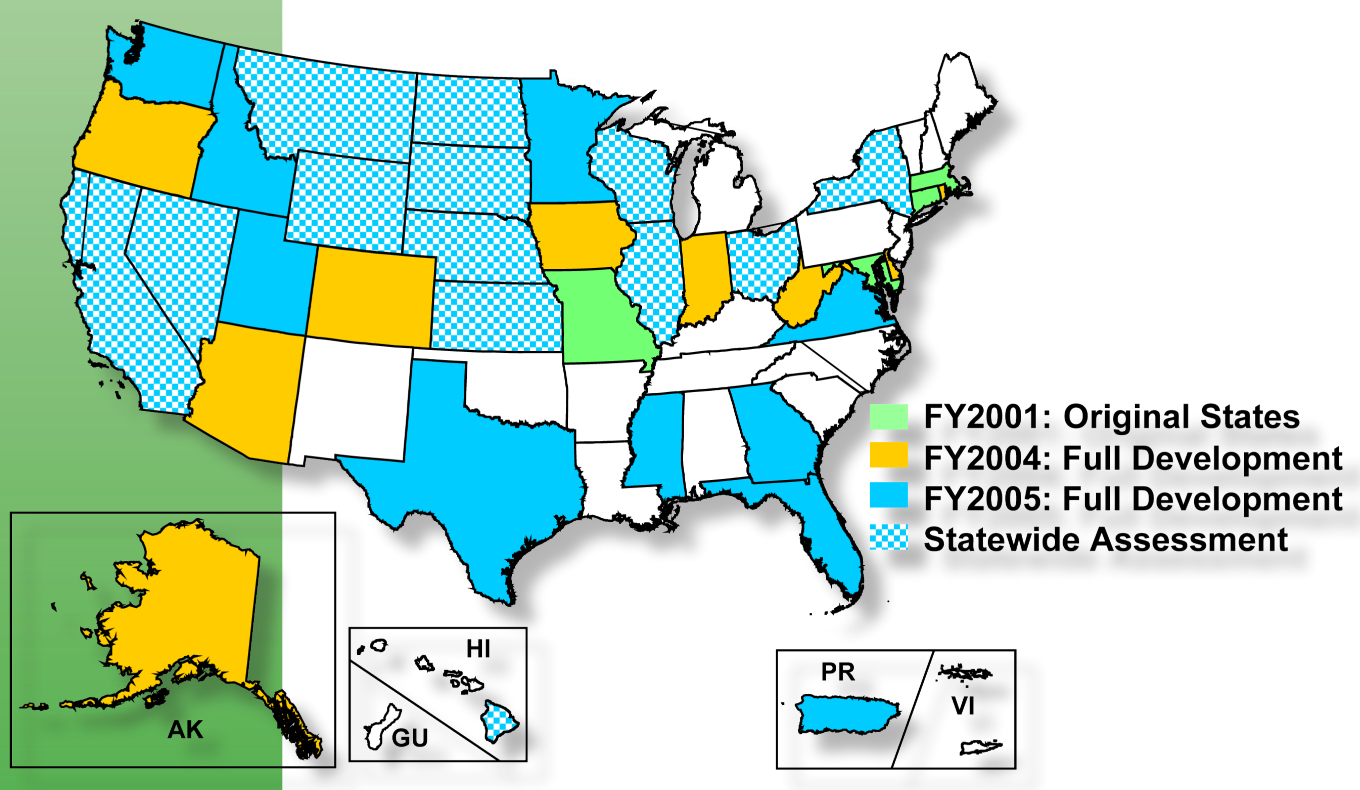
Forest Stewardship Program:

Established through the 1990 Farm Bill, the Forest Stewardship Program (FSP) encourages private forest landowners to manage their lands using professionally prepared forest stewardship plans. These plans consider and integrate forest resources, including timber, wildlife and fish, water, aesthetics, and all associated resources to meet landowner objectives. Nationally, the FSP has been successful in meeting the intent of the program; more than 25 million acres of private forests have been placed under professional forestry management.

SAP Purpose and Background:

Since its inception, the FSP has been delivered and made available to nonindustrial private forest landowners on a first-come, first-served basis. This customer-friendly approach assists landowners in improving their forest resources; however, it fails to allow assessment of the program's full impact across the landscape. It does not take into consideration the connectivity of stewardship tracts, nor does it target landowners whose forest land has a greater need or opportunity for professional expertise and who may not have been aware of resources and programs available to them. There has been no standard or consistent way to assess the impact that stewardship plans have had on the forest resource as a whole, or in addressing regionally or nationally significant resource issues. Given limited program resources and a demand that exceeds program capacity, FSP coordinators and managers increasingly need to address accountability for results on the ground, assuring the Nation's taxpayers that program implementation is efficient and effective, and positively affects forest resources.

1 Text taken from other national SAP documents (see Appendix E)



National SAP Status 6/2005

After over a decade of implementation, it is timely to evaluate the impact the Forest Stewardship Program has had on the landscape and position the program to be strategically implemented to more effectively address critical resource management needs in the future, while meeting landowner objectives.

In FY2001, the Northeastern Area and Connecticut, Maryland, Massachusetts, and Missouri began a pilot Forest Stewardship Program Spatial Analysis Project. The purpose of the pilot was to create a better way to assess the impact of the Stewardship program to date, and to strategically implement the program to more effectively address critical resource management needs in the future.

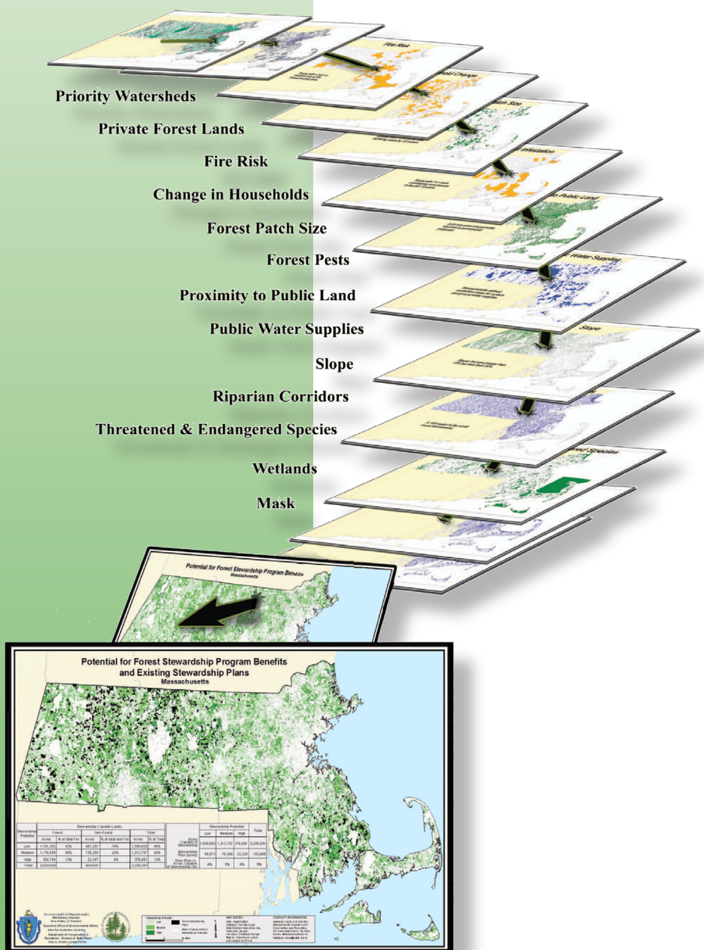
SAP Implementation

The FSP Spatial Analysis Project is comprised of two major components. First is the stewardship suitability analysis. Using the 12 common datalayers (discussed later) developed by the four pilot states, and any other state specific layer of importance, an overlay analysis is conducted. The results of this overlay are then classified into regions of low, medium and high stewardship potential. Once the overlay is finished, it is compared to the second component of the SAP; the historic database of stewardship plans. The plan tract boundaries are digitized into a geodatabase along with relevant attribute information. These digitized plans are combined with the suitability analysis to determine how effective the stewardship program has been based on location of plans and the percentage of plans within each high, medium, and low stewardship potential category. The two components are then used to identify areas of need and opportunity. Strategic delivery of the Forest Stewardship Program is accomplished through pursuing stewardship opportunities of high priority.

Colorado officially beagn the Spatial Analysis Project in June of 2004. Once all of the background information, grant procedures, and hiring was completed, the actual process of collecting the data started in February 2005 and the project was completed in December of 2005.

Part 1. Suitability Analysis

One half of the SAP is the state-wide stewardship suitability analysis. It is comprised of 12 common datalayers, an analysis mask, plus any other state-specific layers deemed important to that particular state. For Colorado, a layer was added to capture the resource potential within non-forested, non-agricultural lands. The layers are divided into four categories: analysis mask, resource potential, resource threat, and optional layers. For a full discussion on the choosing and development of the 12 common datalayers, please see Appendix E (Data Layer Purpose and Outcome).



Overlay Analysis Process

Other Data:

1. Analysis Mask – defines areas for the analysis to take place

Resource Potential:

2. Riparian Corridors – river layer buffered by 300' (or Best Management Practice designation)
3. Priority Watersheds – EPA's percent of impaired waters (or state defined)
4. Forest Patch Size – National Land Cover Data layer values minus road networks
5. Threatened and Endangered Species – T&E species information from state Natural Heritage Program
6. Public Water Drinking Supply Sources – determined by states
7. Private Forest Lands – NLCD forested values on private land
8. Proximity to Public Lands – public and protected lands buffered by 800 meters (~1/2 mile)
9. Wetlands – forested wetlands from GAP vegetation data (or state defined)
10. Topographic Slope

Resource Threats:

11. Forest Health – major insect and disease threats using USFS aerial survey data
12. Developing Areas – census block data
13. Wildfire Assessment – areas of high risk to wildfire (Colorado 2001 WUI assessment)

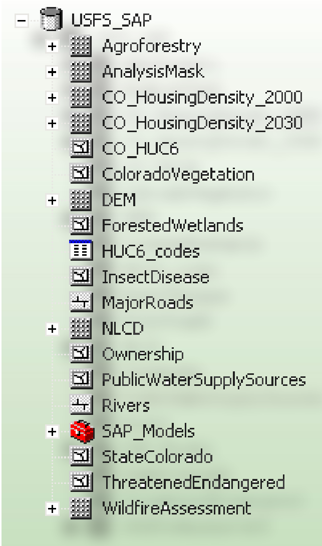
Optional Layer for Colorado:

14. Agroforestry Suitability – areas of agroforestry potential in Colorado

The layers are created as a raster or converted from a vector data type for a faster geoprocessing time and then reclassified to a common scale. Scale values range from zero to one where a 1 indicates the presence of that layer, and a 0 is negative for the presence of that layer. Each layer is weighted and added together (the overlay) to reveal areas of high, medium, and low stewardship suitability. This overlay analysis allows for strategic stewardship program delivery (as opposed to first come, first served method) as well as a spatial means of work planning and prioritizing. The process of developing the individual datalayers for Colorado is described below.

Datalayer Development:

To organize the layers for the analysis, Colorado developed a personal geodatabase containing all of the analysis layers. A custom toolbox was added to the geodatabase that contained the models for analysis. All of the analysis elements are then created within the folder containing that geodatabase. Organizing the data in this manner allows for easy sharing of the data, since all of the analysis, map documents, and workspace are contained within one folder. Consult appendix A to view the models and specific tools used to derive each layer. Metadata was produced for the final 13 layers used in the suitability analysis, the resource richness and resource threats layers, and the stewardship potential layer using FGDC standards.



SAP Personal Geodatatbase

Other Data:

1. Analysis Mask

The analysis mask identifies those cells within the analysis extent that will be considered when performing an operation or a function. Setting an analysis mask means that processing will only occur on selected locations and that all other locations will be assigned values of NoData (ESRI ArcGIS Help). For the purpose of the SAP analysis, the mask includes all areas that are *not* urban/developed areas, public ownership, and open water. The mask was created by combining a grid of NLCD (online source: http://www.epa.gov/mrlc/nlcd.html) suitable areas and a grid of privately owned lands. The NLCD values of 11, 12, 21, 22, 23, 31, and 32 (see Appendix B for NLCD definitions) received a NoData value and the remaining NLCD values received and a 1. Private lands in the grid receive a value of 1. When the rasters are combined using the Weighted Overlay tool, the mask is produced. The Anlaysis Mask layer is used as several of the environment settings, so this layer will be the first to be modeled and run. This saves some process steps in the analysis.

Resource Potential:

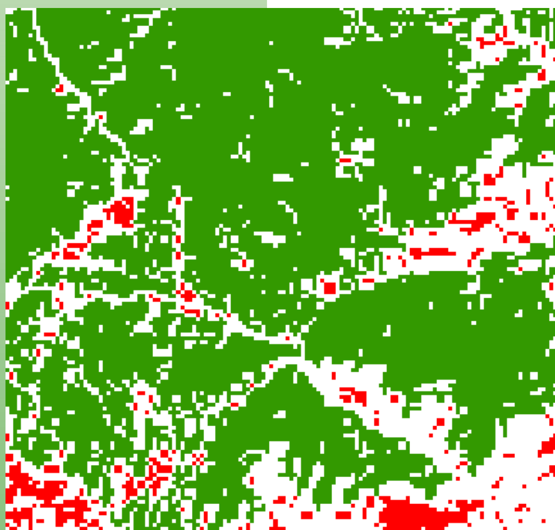
1. Riparian Corridors - The riparian zone dataset is created by buffering the Rivers feature class (ESRI dataset; 1:24,000 scale) by 300'. Final grid name = rc_river_buff

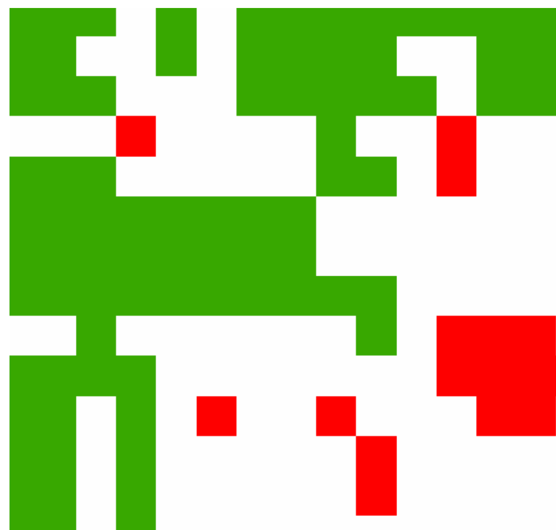
2. Priority Watersheds – Priority Watersheds in Colorado were determined using the 2002 Percent of Impaired Waters data produced by the EPA (Online Source: http://www.epa.gov/waters/data/downloads.html). Sixth level hydrological units were classified based on a scale developed by the EPA to signify the percentage of waters impaired in each hydrologic unit. The shapefile was then converted to raster and reclassified to a 1,0 scale. Hydrologic units with any percentage of impaired waters received a 1, while those units without any impairment received a 0. Final grid name= rcpriority_ws

3. Threatened and Endangered Species – Threatened and endangered species information was collected from the Colorado Natural Heritage Program (online source: http://www.cnhp.colostate.edu/gis.html). This data was converted to a grid with occurrence areas rating as a 1 and other areas as 0. Final grid name = rc_tande

4. Forest Patch Size – The goal of the forest patch size dataset is to determine a minimum patch size for the state and emphasize management of these forested areas. For Colorado, large continuous patches of forest generally create high wildfire hazard. Management activities are focused on reducing hazardous fuels and promoting a healthy forest. To create the dataset, larger contiguous patches of forest need to be isolated and patches below the size threshold need to be removed. The patch size for analysis was set at 1,000 acres or 4,046,862 m^2 (square map units). For this analysis, 1,000 acres seemed an appropriate size to complement the state-wide scale of analysis, and allowed for faster geoprocessing times. Forested values in the NLCD dataset are selected (41,42,43,51,91), then a buffered (100ft.) road layer is subtracted from the forested areas to create a layer of forest patches. The patches are classified by size using the Region Group and the Zonal Geometry tool. Patches over 1,000 acres are extracted using the Extract by Attributes tool.

While a model was built to run each process, the actual process took place using ArcMap and the Saptial Analyst toolbar because of a bug in Model Builder not honoring the Environment Settings of the analysis. There were problems using the buffered road layer as well. Because of the 100 meter cell size used in the analysis, the road layer became fragmented and as a result, would not 'punch through' the forested layer. This created invalid areas of forest. To overcome this problem, a 25 meter cell size was used to create the road raster. Then the road grid was expanded one cell to fill in the roads, allowing them to fully punch through the forested areas and removing the invalid forest areas. Admittedly, this increased the road buffer by an amount of 25 meters. Final grid name = rc_ac_patch





Stands >1000 acres are green <1000 acres are red. The right hand image shows that the Region Group operation only includes contiguous cells.

5. Public Water Drinking Supply Sources – Created by the Colorado Department of Health by looking at areas of watersheds that drain into water intake points. This data was then converted to a grid and reclassified so that land within source areas receive a value of 1 and other areas receive a 0 value. The public water drinking supply source datalayer is a restricted dataset, and will not be distributed with the SAP deliverables. Final grid name = rc_pub_water

6. Private Forested Lands – Created by selecting the values of 41, 42, 43, 51, and 91 from NLCD data. Since the model has the analysis mask set in the Analysis Properties the resulting grid is only created in areas of Stewardship Suitability. This saves a step in the analysis. Final grid name = nlcd_forested

7. Proximity to Public Lands – An 800 meter (~1/2 mile) buffer of public lands was created to locate private lands in proximity to public lands. Using a Colorado ownership dataset produced by Dr. David Theobald of Colorado State University (see metadata for citation information), all lands were selected that were *not* public with the following expression: [OWNER] <> 'Private'. For each tool in this step the analysis extent must be set to the entire analysis area (over-ride the analysis mask in the model settings) or this will not work. Final grid name = rcpub_land_ex

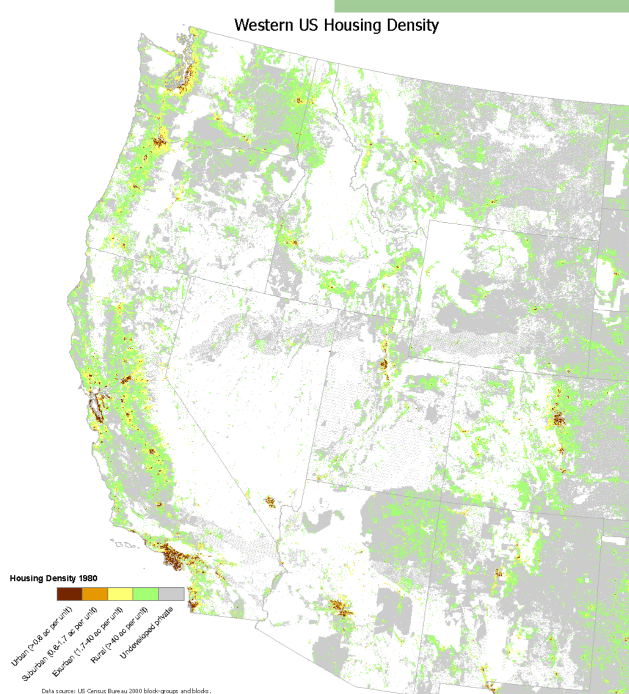
8. Wetlands – The data for forested wetlands came from state GAP vegetation information (online source: http://ndis1.nrel.colostate.edu/cogap/). The code 61001 was chosen from the PRIMARY field. The resulting vector layer was then converted to a raster. Final grid name = rc_for_wet

9. Topographic Slope – A DEM of Colorado (online source: http://ned.usgs.gov) was used to create the percent slope layer in the analysis. This grid was then reclassified to a value of 1 for slope between 0-50% and 0 for all other values. The slope classification is the range of operability (for mechanical harvesting) in Colorado. Final grid name = rc_per_slope

Resource Threat:

10. Forest Health – Bark beetle epidemics are the largest insect and disease threat to Colorado's forests. Using the USFS Forest Health Aerial Survey information (online source: ftp://ftp2.fs.fed.us/incoming/r2/ro/aerial_survey/), DCA1 codes of 11000, 11002, 11006, 11007, 11009, 11029, 11030, and 80004 were selected to isolate areas of bark beetle (prominent Dendroctonus and Ips species) activity. This information was then converted to a grid. Final grid name= rc_barkbeetle

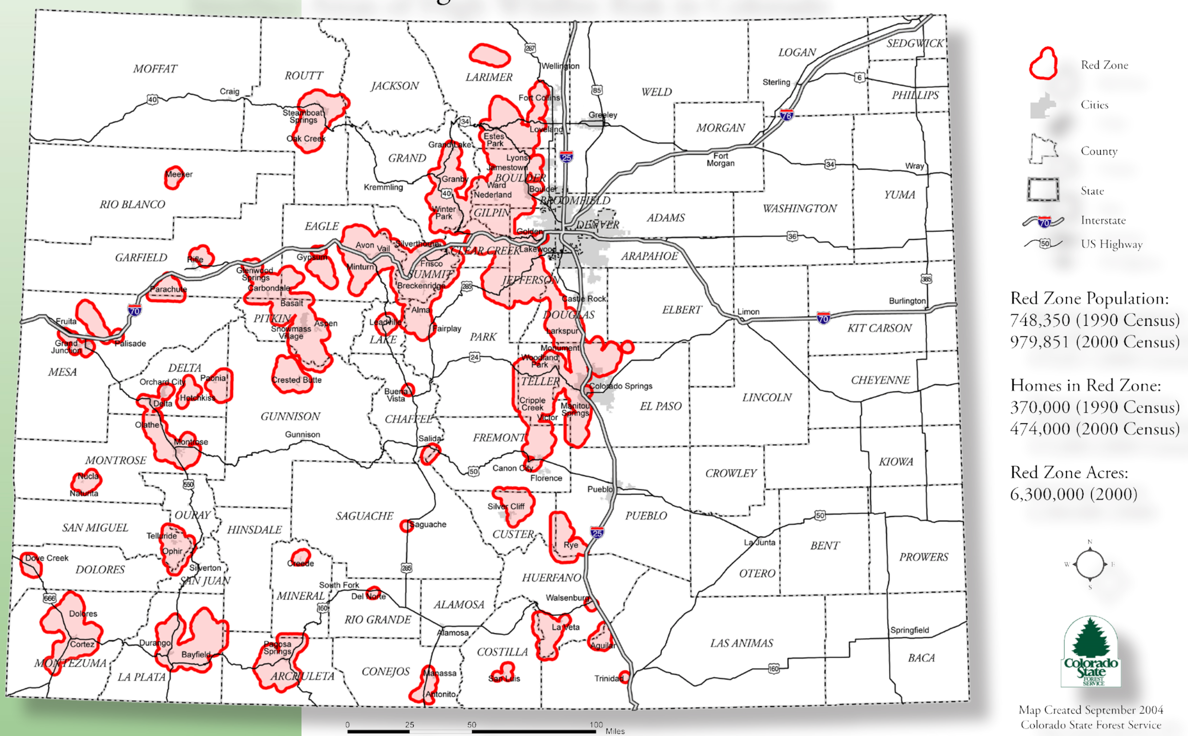
11. Developing Areas – Dr. David Theobald produced the housing density layer used for the Colorado SAP analysis (see metedata for citation information). The data is an updated version (v4) of the housing density data produced from his Forests on the Edge study. The data was produced from subtracting public lands and water areas from 2000 Census block data then calculating acres per house. Housing density was projected forward using current development trends. For the SAP analysis, 2030 density projections were subtracted from the 2000 density to determine areas under pressure from development. Lastly, the raster was reclassified so developing areas return a value of 1 while other areas return a 0 value. The datalayer was produced within ArcMap rather than Model Builder to speed up processing times (due to a bug in Model Builder not recognizing the analysis extent and subtracting density values for the whole country instead of just Colorado). Final grid name = rc_house_den



Western US Housing Density - Dr. David Theobald

12. Wildfire Assessment – The wildfire assessment layer was created by reclassifying the 2001 Wildland Urban Interface Hazard Assessment for Colorado. The values for the assessment ranged from 2-14 with values 10-14 being selected as the high values. Values 10-14 were reclassified to a value of 1 with other values being changed to 0. Final grid name = high_wf_haz

Interface Areas of High Wildfire Risk in Colorado



Wildfire risk and Colorado

Optional Layer for Colorado:

13. Agroforestry Suitability – Created by adding NLCD values of 51,71, and 91 with all elevations under 10,000ft (from a 30 meter DEM) using the Weighted Overlay tool. These are areas in Colorado that can sustain agroforestry work. Final grid name = rc_agorforest

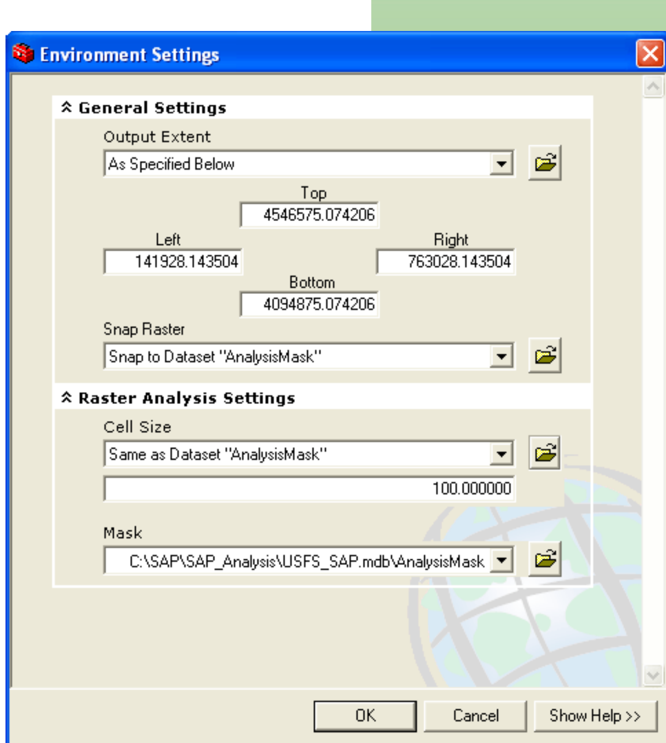
Model Builder:

Colorado used the ArcGIS Model Builder to model and run each of the analysis steps. Four models were created, the first for the Analysis Mask, the second for the forest patch layer, the third for the optional agroforestry layer, and the fourth to run the suitability analysis. Even though every process was modeled using model builder, some geoprocessing still occured in ArcMap due to some irregularities with Model Builder processing. All of Colorado's models are in Appendix (A).

For the SAP models certain analysis properties will need to be set. The Anlaysis Mask layer is used as several of the environment settings, so this layer will be the first to be modeled and run.

Under Model, select Model Properties and the analysis properties will be displayed for the current model. Select the check boxes for Output Extent under General Settings and check Cell Size and Mask under Raster Analysis Settings. Click on the Values Button and the Environment Settings box will appear. In this box set the Output Extent to the state or region being modeled. Set the Raster Analysis Settings to Same as Dataset "Analysis Mask" created by combining a grid of NLCD suitable areas and a grid of privately owned lands and set the Mask same datalayer. Using this mask will force the analysis to occur in suitable areas only. This saves some process steps in the analysis.

Set the output extent, snap raster, cell size, and mask to the Analysis Mask previously created to ensure that all datalyers line up with each other. This will eliminate any cell overlap. In this screen shot, the Output Extent is set to Colorado's Analysis Mask, but when a snap raster is chosen, the output extent defaults back to the 'As Specified Below' option (although the actual extent remains the same).



Environment settings in Model Builder

Datalayer Weighting Process:

Not all layers within the analysis are equally important to forest stewardship suitability. Each has a varied degree of influence determined by local resource issues. In Colorado, the threat of wildfire has become the resource issue of highest importance. Conversely, riparian corridors are not as influencial when determining stewardship suitability in Colorado. To account for the variance of influence, all data layers were weighted. In effect, the weighting skews the suitability analysis in favor of layers with greater importance. For the sake of simplicity, Colorado chose to assign different influence percentages to each layer. This percent influence was determined from both the strategic priorities of the agency and resource issues of current importance such as wildfire or the recent bark beetle epidemics.

Once the percent influence for each layer was determined, the layers were multiplied by their corresponding percent influence, then added together. In the final analysis, this returned values between 0 and 1, with values closer to 1 having a higher stewardship potential.

Datalayer Weights:

Wildfire Hazard: 15% (0.15)
Private Forested: 12% (0.12)
Insect & Disease: 12% (0.12)
Public Drinking Water Sources: 12% (0.12)
Change in Housing Density: 10% (0.12)
Proximity to Public Lands: 8% (0.08)
Agroforestry: 6% (0.06)
T & E Species: 6% (0.06)
Forest Patch Size: 5% (0.06)
Slope: 5% (0.05)
Forested Wetlands: 3% (0.03)
Priority Watersheds: 3% (0.03)
River Riparian Areas: 3% (0.03)

Results:

Actual analysis values were between 0 (201 cells out of a possible 28,055,087 cells) and 0.97 (7 cells). The 0.97 high value indicates there was no cell that 'hit' all layers, while there were a few cells that hit none of the layers. After the analysis was run, the low, medium, and high classes were determined using the Natural Breaks classification algorithm. Class values were defined as follows:

Low:	0-0.20
Medium:	0.21-0.38
High:	0.39-0.97

The analysis grid was then reclassified to an integer grid with values of 1, 2, and 3, to represent areas of low, medium, and high stewardship potential, respectively.

Stewardship Potential	Stewardship Capable Lands					
	Forest		Non-Forest		*Total*	
	Acres	% of total For.	Acres	% of total non-For.	Acres	*% of Total*
High	4,720,447	49%	858,443	3%	5,578,890	*15%*
Medium	4,784,200	50%	7,386,710	26%	12,170,910	*32%*
Low	89,081	1%	19,820,786	71%	19,909,867	*53%*
Total:	*9,593,728*		*28,065,939*		*37,659,667*	

Table from Analysis Map #2 showing the Stewardship Capable Lands in Colorado

	Stewardship Potential			*Total:*
	Low	Medium	High	
Acres Capable of Stewardship:	19,909,867	12,170,910	5,578,890	37,659,667
Stewardship Plan (acres):	41,902	216,733	153,230	411,865
Stew.Plan vs. Acres Capable of Stewardship (%):	0.2%	1.8%	2.7%	1.1%

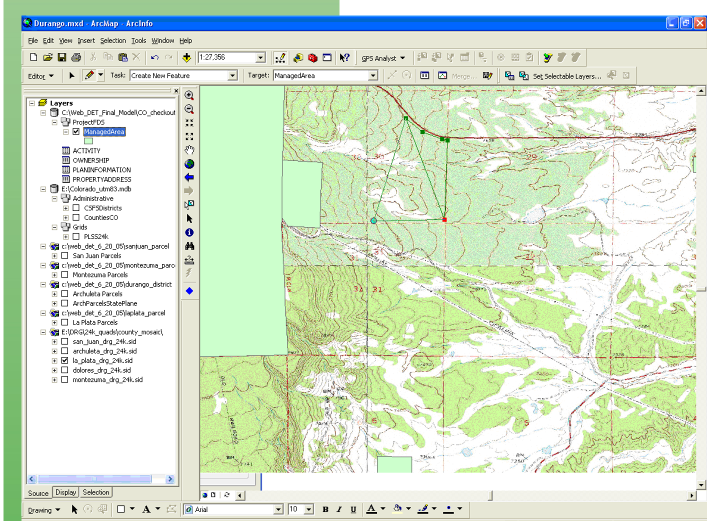
Table from Analysis Map #2 showing the Stewardship Potential acres in Colorado

2. Stewardship Plan Digitizing

The other main component of the Spatial Analysis Project is the collection and digitizing of stewardship plans for use in the suitability analysis. For Colorado, this process proved to be the most time-consuming since all records were created from scratch. In Colorado, stewardship plan information is not centrally located. Each of the 17 CSFS distrcits was visited to collect the necessary information. Collecting the information from each district was time consuming because every district had a different method of filing and organizing plan information. Another hurdle faced in data collection was inadequate plan information. On plans created at the beginning of the stewarship program maps were sometimes not included in the report. Because of this, the plan was not able to be digitized into the geodatabase used to store the SAP data. Overall, there were 289 plans that did not make the SAP database due to a lack of topographic map (or any other way to digitize the plan boundary).

Procedures:

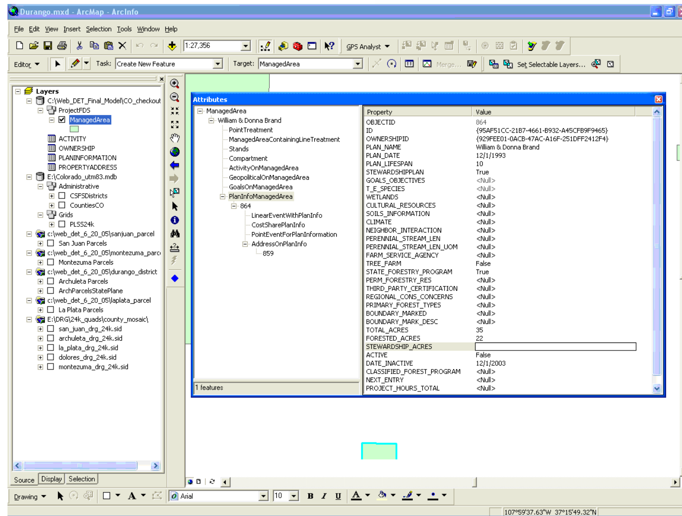
The first step in digitizing stewardship plans for the SAP was to determine how they would be stored. Colorado decided to store the data in the personal geodatabase designed for the Web-DET application (see Appendix C). Before the Web-DET geodatabase was designed, other states stored the plan boundaries in a shapefile while the attribute information resided in an Access database. Once the geodatabase was designed, stewardship plan boundaries were either heads-up digitized from the stewardship plan topographic map and a corresponding topographic DRG layer into the Managed Area feature class of the geodatabase, or they were copied from existing county parcel data and pasted into the geodatabase. Once the plan boundary was digitized, specific plan information was entered manually into the geodatabase attribute tables using the Attribute Editor in ArcMap. The PLANINFORMATION, PROPERTYADDRESS, OWNERSHIP, and ACTIVITY tables in the geodatabase were populated from written plan information.



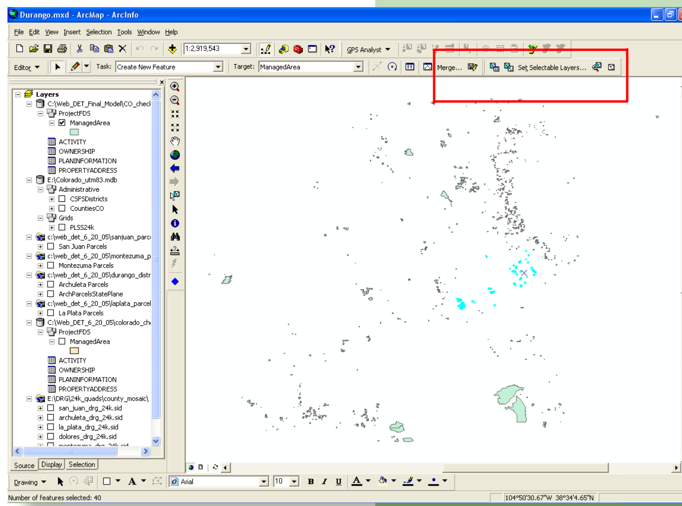
Heads-up digitizing a stewardship plan boundary

To speed up data entry, a custom toolbar was created which contains commands to easily access repeated processes. Creating this toolbar takes only minutes, and the efficiency gained over almost 900 stewardship plans was significant.

If stewardship data is already digitally maintained, there are procedures developed to migrate that data into the Web-DET geodatabase without starting from scratch. These procedures describe a process of merging stewardship data from the old SAP Access database and corresponding shapefiles or previous Web-DET geodatabase versions into the current Web-DET geodatabase. See Appendix D for complete instructions on data migration.



Using the Attribute Editor to enter plan information.



These commands were added to the map document to increase efficiency

Metadata:

Metadata was produced for the Managed Area feature class and the geodatabase attribute tables using the FGDC metadata editor in ArcCatalog. Metadata was produced to Federal Geographic Data Committee (FGDC) standards.

Analysis & Map Products:

Completion of the Spatial Analysis Project requires the intial suitability analysis plus a series of seven maps each requiring their own analysis and statistics. As mentioned above, the analysis was completed in a grid environment. Colorado chose to run the analysis with a 100 meter cell size for each grid. This significantly reduced geoprocessing times. The 100 meter cell size was also chosen to match the resolution of most datasets used in the analysis. At approximately 2.5 acres, the 100 meter cell size is also suitable for a more local analysis (as opposed to state-wide).

Each map and analysis will be discussed individually below.

Map notes: Colorado changed the Analysis Mask legend item from: Analysis Mask to: Areas Without Stewardship Potential to more accurately reflect the areas without stewardship potential (since the mask identifies areas in which analysis *occurs*). This change is refelected in each map. Once the maps were finished, they were exported as a .pdf file for easier viewing, printing, and distribution (When exporting from ArcMap, make sure the 'embed all fonts' option is checked).

Map #1: *Potential for Forest Stewardship Program Beneifits*

Map #1 displayed the state-wide suitability analysis. Accompanying the map is a table comparing each level of satewardship potential with total stewardship capable lands. This table was created using the Tabulate Area tool. The analysis mask defined the zones, while the stewardship potential grid defined each value (low, medium, high). In every map in which the Tabulate Area tool is used, the created .dbf table is opened in Microsoft Excel for calculations. Values are summed and then converted to acres (from square meters). The table is then saved as an Excel worksheet.

Map #2: *Potential for Forest Stewardship Program Benefits and Existing Stewardship Plans*

Existing stewardship plans are overlayed with stewardship potential in this map. Another table is created, comparing stewardship plan acres to total acres capable of stewardship. These numbers are derived using the Tabulate Area tool. For this map, stewardship plans define the zone, while stewardship potential defines the values. For this tool to work properly, the Managed Area feature class containing the stewardship plans had to be exported as a shapefile, and the shapefile used to define the zones. It is still unclear if this is a bug at 9.0, or a problem with the particular computer used.

Map #3: *Forest Stewardship Potential on Private Forest Lands and Existing Stewardship Plans*

Map #3 looks at stewardship potential only on private forest land. To create the private forest land layer, NLCD forested values (41, 42, 43, 51, 61, 91) are combined with a private land ownership layer. Once this layer (private land plus forested values) is created, it is added to the stewardship potential layer with the resulting dataset of stewardship potential on only private forest lands. The Anlaysis Mask legend item is changed to: *Non-Forest* to more accurately represent the white areas of the map. The Non-Forest, Non-Developed legend item was changed to: All-Forests to show areas of all forests in Colorado compared to private forest land. The table in map #3 of stewardship potential on private lands was created with the Tabulate Area tool. The private forest dataset defined the zones, while steardship potential defines the values.

Map #4: *Resource Richness*

The resource richness map displays an aggregate of selected resource potential data themes. Colorado added the agroforestry layer as well as the T & E species layer. In adding these (resource potential) data themes together, Colorado kept the relative weights assigned in the suitability analysis. The data was then normalized to match the 0 to 1 scale used in the suitability analysis.

Map #5: *Resource Threats*

The resource threats map is the opposite of the resource richness map. All three resource threats data themes from the suitability analysis are used to derive the resource threats map. Again, Colorado kept the relative weights of each layer then extrapolated them to normalize the data. Doing so maintains the same scale used in the suitability analysis.

Map #6: *Forest Stewardship Program Potential on Non-Forested – Non-Developed Lands and Existing Stewardship Plans*

Map #6 displays forest stewardship potential on all stewardship capable lands that is not reflected in the private forest map (map #3). The non-forest – non-developed (nfnd) grid is combined by selecting the appropriate NLCD values, and adding them to the stewardship potential grid. The Tabulate Area tool was then used to produce the nfnd stewardship potential table. The nfnd layer defines the zones, and the stewardship potential layer defines the values.

Map #7: *Forest Stewardship Potential on Private vs. Non-Forest and Existing Stewardship Plans for the Denver Area*

Colorado's regional map juxtaposes forested and non-forested stewardship potential. The forested stewardship potential retains the green color scale while the non-forested areas receive an orange color scale. A map scale of 1:200,000 was chosen for the map. This scale shows stewardship potential in detail for the Denver area. Other data layers such as roads, rivers, lakes, and municipal areas are then added to the map to better place stewardship potential. Production of more regional and area maps by Colorado State Forest Service will prove to be beneficial in work planning and prioritizing.

Update Cycle and Future Uses of the Data

For continuing effectiveness in FSP strategic delivery, both components of the SAP should be updated. Using Web-DET will ensure the stewrdship plan database will be continually current. The stewrdship potential dataset will be updated as new, improved data becomes available, or as angency priorities and resource issues change.

The usefuleness of SAP data goes beyond that of stewardship planning. By weighting the layers according to resource issues and agency priorities, the data provides important areas of focus for many CSFS programs. Combinging both stewardship plan location and stewardship potential with maps of other activities such as fuel reduction or forest restoration projects will help maximize total CSFS effectiveness in providing stewardship to Colorado's forest resources.