LANDFIRE Biophysical Setting Model

Biophysical Setting 1511551 **North American Warm Desert Riparian Systems**

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models:* *BpS 1511550 was split between 1511551 dominated by mid to large perrennial rivers where Native American use was possible and 1511552 that represents smaller riparian stringers with either intermittent water or subsurface groundwater flow (washes, canyon corridor, small streams) imbedded in the creosote and paloverde matrix.*

General Information

Contributors (also see the Comments field) **Date** 10/18/2005

Modeler 1	Janet Grove	jgrove@fs.fed.us	**Reviewer**
Modeler 2	Holly Richter	hrichter@fs.fed.us	**Reviewer**
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Vegetation Type

Wetlands and Riparian

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species

POFR2
PLSE
ATLEB
SAEX
TYAN
DISTI
WAFI
PROSO

Map Zone

15

Model Zone

☐ Alaska
☐ California
☐ Great Basin
☐ Great Lakes
☐ Hawaii
☐ Northeast
☐ Northern Plains
☐ N-Cent.Rockies
☐ Pacific Northwest
☐ South Central
☐ Southeast
☐ S. Appalachians
☑ Southwest

Geographic Range

Perennial and intermittant desert drainages in central and southwestern AZ.

Biophysical Site Description

Riparian systems occur primarily along perennial streams/rivers along the Lower Colorado, Lower Salt, Lower Verde, Lower Gila, Big Sandy, Bill Williams, Santa Maria, Hassayampa and Lower Santa Cruz corridors adjacent to Sonoran Desert Scrub.

Vegetation Description

The vegetation is a diverse mosaic of riparian forests, shrublands, streamside marshes and barren alluvial surfaces. Larger river systems were dominated by gallery forests. Dominant species are Salix gooddingii, Populus fremontii, Distichlis spicata, Scirpus spp, Typha spp, Prosopis spp, Baccharis salicifolia and Muhlenbergia rigens. Vegetation is dependent upon periodic flooding. Native Americans also had a strong influence on vegetation composition and structure by favoring edible plants (eg, mesquite), collecting fuel wood and burning to flush animals and increase accessibility to open water and agricultural fields.

Disturbance Description

This BpS is a flood-dependent ecosystem. The entire range of flood magnitudes contribute to ecological processes such as nutrient cycling, recruitment, species composition. Two to ten-year events primarily

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impact herbaceous vegetation, 7-50yr events result in patchy removal of shrubs and saplings. 50yr+ events remove stands of larger trees. Cottonwood will return to pole size within 10yrs of disturbance. Cottonwood is considered mature around 60yrs.

New mud/silt flats created by flooding were cultivated for corn, bean and squash by Native Americans (we assumed 10% utilization of class A per year to imitate 50% utilization during the first year only). Farming would be a stand replacing events that prevented cottonwood and willow seedling establishment.

Fuel characteristics and fire behavior are extremely variable, due to the wide range of vegetation types that characterize the riparian zone and to Native American manipulations. In general fuels are typically continuous and fuel loads high, but fuel moisture content is also often high. Wildfires may not carry except under extreme fire weather conditions (average FRI for replacement fire is 500-1000yrs; assumed 750yrs). For stands not recently tended by Native Americans, higher fuels loads allow for an average FRI of 500yrs, whereas the intense collection of fuel wood (30% of area of late-development cottonwood dominated) and prescribed burning for hunting and agricultural purposes increased the mean FRI to 1000yrs. Native Americans had a profound influence on these systems with the development of irrigation ditches, crop production on silt/mud flats deposited by yearly floods, the burning of willows for basketry (only first-year willows can be used for weaving), to maintain open irrigation ditches and agricultural fields, and burning to facilitate access and flush jackrabbits, game birds and deer. A mixed severity FRI of 10-20yrs was assumed, respectively, for late-development and mid-development and was calculated by assuming that Native Americans burned every year but affected only 10-5%, respectively, of the floodplain per year (thus, probability/year of 0.1-0.05). It was also assumed that older stands received more burning than younger stands that provided less fuel wood. Fire was applied in the fall when fuels would be cured and dry. Thus, the historic fire regime is characterized by small to moderate sized, complete, high intensity passive crown fires, and small moderate intensity fires set frequently by Native Americans. FRG is difficult to identify because it is either V, I or II. In the absence of native bruning, the FRG will be V.

Willow resprouts more vigorously than cottonwood from fire. Woodland dominants such as Fremont cottonwood (Populus fremontii) honey mesquite (Prosopis glandulosa), and willows (Salix spp) typically resprout after being topkilled. However, resprouting individuals and seedlings are susceptible to mortality during recurrent fires.

Adjacency or Identification Concerns

Exotic trees of Tamarix spp and Bromus rubrum, Bromus tectorum and Bermuda grass are common in some stands.

Water diversions and groundwater pumping have greatly modified hydrologic regimes and water levels, perhaps permanently.

Livestock grazing can be a major influence in the alteration of structure, composition and function of the community.

In riparian woodlands the invasives saltcedar Tamarix spp, Bromus rubrum, Bromus tectorum and Bermuda grass are common in some stands and create contiguous fuels that allow fire to spread. After an initial fire, these invasives may quickly recover and surpass their pre-fire dominance, promoting increasingly more frequent and intense fires, which can eventually displace native plants.

Native Uncharacteristic Conditions

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Canopy cover can reach 100%.

Scale Description

These systems can exist as small to large linear features in the landscape. In larger, low elevation riverine systems, this system may exist as mid-large patches.

Issues/Problems

Comments

This model is based on the model for the same BpS in MZ14. Modeler of 141155 also includes Brooke Gebow (bgebow@tnc.org). BpS 141155 was created by substantially revising BpS 131155a. Many changes were done. 1) Floods causing stand replacing events were more frequent (5-50yr, 50yrs+, for respectively, mid- and late-development classes); classes C and D in 131155a were merged into class C (still accounting for Native American influences); and class D is Mesquite Bosque, which is the last successional phase in the floodplain (not in the Mojave Desert), with 500yr flood replacement events and replacement fire every 250yrs on average; and, although Native American influences were maintained, the importance of mixed severity was implicitely reduced by removing time since disturbance from BpS 131155a.

For BpS 131155a, Native American burning was introduced as a very plausible disturbance, however no data or expertise were available. Consultation with ethno-biologist Kay Fowler, resulted in modifications to the original model and description. The native American influence was greater than initially thought with farming of mud flats (not in late development stands as initially modeled), irrigation, massive fuel wood collection and extensive small-scale burning for willow control, basketry, general access and hunting. Therefore, very frequent mixed severity fire was added by Louis Provencher to the mid-development closed and late-development closed stage, the time since disturbance was shorten from 50 to 15 years and farming and fuel collection were added, respectively, as model parameters in early and late-development open classes. Mixed severity fire and fuel wood collection was added to the late-development closed class to represent Native Americans utilization of neglected or virgin stands. These last parameters had a large influence on model results.

Suggested reviewers: Dave Gori (TNC AZ), Julie Stromberg, ASU, Dan Robinette (NRCS Tucson) and Richard Felger (rfleger@ag.arizona.edu).

Final quality control for MZ15 (Pohl 10/18/2005) resulted in changes to the structure data for all classes to adhere to LF standards.

As part of LF re-mapping of 8 western map zones in March 2007, this model was split as was done in MZ13 and MZ14. The original model 1511550 was retained as 1511551, as was done in MZ13 and MZ14. 1511552 was copied from MZ14.

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for mixed severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

Vegetation Classes

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Class A **20 %**

Early Development 1 All Structure

Upper Layer Lifeform

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

Fuel Model

8

Indicator Species and Canopy Position

SAGO
Upper
POFR2
Upper
BASA
Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	0 %	100 %
Height	Shrub 0m	Shrub 3.0m
Tree Size Class	No data	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Immediate post-disturbance responses are dependent on pre-disturbance vegetation composition. Species composition vary with fire (Salix gooddingii favored) or flood magnitude (Salix gooddingii and Populus fremontii favored by flooding). This class is typically shrub/seedling dominated, but grasses may co-dominate. This class also exists as recently deposited mud/silt flats that may be farmed for corn, squash and beans.

Generally, this class is expected to occur 1-5yrs post-disturbance. Modeled disturbances include 1) stand-replacing flood events for herbaceous vegetation and seedlings approximately every seven years and 2) farming was applied to new mud flats and prevented germination of cottonwood and willow (10% area per year).

Transition to Class B after five years.

Class B **25 %**

Mid Development 1 Closed

Upper Layer Lifeform

- [ ] Herbaceous
- [ ] Shrub
- [x] Tree

Fuel Model

8

Indicator Species and Canopy Position

SAGO
Upper
POFR2
Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	0 %	100 %
Height	Tree 0m	Tree 5m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Highly dependent on the hydrologic regime. Vegetation composition includes tall shrubs and small trees (willows & cottonwoods). Modeled disturbances include 7-50yr flooding events (used 15yr flood events) on mid-level terraces causing stand replacement. Native mixed severity burning in the fall for basketry, clearing of irrigation ditches and hunting was conducted every year on five percent of the area. Shrubs resprouted vigorously the year following burning. Succession to class C after 15yrs.

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Class C **35 %**

Late Development 1 Closed

Indicator Species and Canopy Position

POFR2
Upper
SAGO
Upper
PROSO
Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	Large 21-33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

8

Description

This class represents the mature, large cottonwood and willow riparian woodlands. Mesquite increases in importance in the midstory and lower canopy. When Native Americans used this class, the midstory shrub component was tended and open, but the tree canopy was generally unaffected. Native American burning was every year in 10% of area in small patches, most likely to flush jackrabbit and deer, and to control willow encroachment near waterways (irrigation ditches or side channels) and agricultural fields situated on nearby alluvial deposits. Fuel collection was an important activity resulting in understory thinning and fuel load reduction in 30% of the area every year. Stand replacement was caused by 50yrs+ flooding events and rare wildlire (mean FRI of 750yrs). Succession to class D after 90yrs.

Class D **20 %**

Late Development 2 Closed

Indicator Species and Canopy Position

PROSO
Upper
CEPA8
Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	Large 21-33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

8

Description

Mesquite dominates the riparian floodplain. Salix goodingii and Populus fremontii are a minor component in this class. Vegetation would remain in this condition unless 500yrs+ flooding events and fire every 250yrs on average would cause stand replacing events.

Class E **0 %**

[Not Used] [Not Used]

Indicator Species and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover	%	%
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Disturbances

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Fire Regime Group:** I

Historical Fire Size (acres)

Avg 50
Min 1
Max 100

Sources of Fire Regime Data

☐ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	769	500	1000	0.00130	3
Mixed	21			0.04762	97
Surface					
All Fires	20			0.04893	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

Additional Disturbances Modeled

☐ Insects/Disease
☑ Wind/Weather/Stress
☐ Native Grazing
☐ Competition
☑ Other (optional 1) farming
☐ Other (optional 2)

References

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NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Richter, H.E. 1992. Development of a conceptual model for floodplain restoration in a desert riparian system. Arid Lands 32: 13-17.

Stromberg, J. 1992. Element Stewardship Abstract for Mesquite (Proposis spp.). The Nature Conservancy, Arlington, VA.

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