LANDFIRE Biophysical Setting Model

Biophysical Setting 1511552 North American Warm Desert Riparian Systems - Stringers

☐ *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 blackbrush matrix vegetation.*

General Information

Contributors (also see the Comments field) **Date** 5/6/2006

Modeler 1	Louis Provencher	lprovencher@tnc.org	**Reviewer**	
Modeler 2			**Reviewer**	
Modeler 3			**Reviewer**	

Vegetation Type

Wetlands and Riparian

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species

ACACI
SAEX
PROSO
PLSE
DISP
SPAI
POFR2
FRVE2

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

Found in the warm deserts of the southwestern US. Intermittent to dry warm desert (Mojave and Sonoran Deserts) drainages with mostly subsurface flow in southern CA, NV, AZ and southwest UT.

Biophysical Site Description

Narrow riparian systems occur primarily along low elevation shrublands (creosote, blackbrush and paloverde matrix vegetation) and in canyons, washes or as spring brooks. Elevation is typically below 4000ft. Examples of intermittent streams can be found in the Amargosa Gorge, Whitewater River, Andreas Canyon, Paiute Creek and Palm Canyon. Oasis woodlands occur in isolated stands such as the Palm Canyon, Thousand Palms and Twentynine-palms oases.

Vegetation Description

The vegetation is a mix of riparian shrublands dotted with tree species Salix gooddingii, Populus fremontii and Fraxinus velutina where water surfaces. Patches of grassland and forbs (Distichlis spicata, Sporobolus airoides, Carex spp and Pluchea sericea) are present but not extensive. Dominant shrubs include Acacia spp, Salix exigua, Prosopis spp and Washingtonia filifera (in oases primarily). Mesquite occurs as dispersed shrubs, not bosque. Halophytic shrub-dominated patches occur on drier sediment deposits or saltier surfaces. Vegetation is dependent upon periodic flash flooding. Native Americans had a minor effect on these riparian systems compared to larger floodplains.

**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.

Disturbance Description

This BpS is a flash flood-dependent ecosystem. The entire range of flood magnitudes contribute to ecological processes such as nutrient cycling, recruitment and species composition. Two to 10yr events (7yr event used) primarily impact herbaceous vegetation, 7-50yr events (20yr events used) result in patchy removal of shrubs and saplings. 50yr+ events (50yr event used) remove stands of larger trees. Cottonwood, if present, will return to pole size within 10yrs of disturbance. Cottonwood is considered mature around 60yrs.

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. The average FRI for replacement fire is 500-1000yrs; assumed 1000yrs ofr mid-development riparian vegetation and 500yrs for late-development vegetation. Native American burning of desert washes was assumed rare. Willow and mesquite resprout after fire.

Adjacency or Identification Concerns

Creosote (BpS 131087) and blackbrush (BpS 131082) will be immedaitely adjacent to BpS 1311552 and the transition is sharp to riparian vegetation.

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.

Exotic trees of Elaeagnus angustifolia and Tamarix spp are common in some stands.

In some riparian woodlands, the invasives saltcedar (Tamarix spp), and less frequently giant reed (Arundo donax), can create ladder fuel that allows fire to spread from surface fuel of willow (Salix spp), saltbush (Atriplex spp), sedge (Carex spp), reed (Juncus spp) and arrow weed (Pluchea sericea) into the crowns of overstory Fremont cottonwood trees, top-killing them. After an initial fire, these invasives quickly recover and surpass their pre-fire dominance, promoting increasingly more frequent and intense fires which, can eventually displace most native plants.

In palm oases, Washington fan palms depend on surface fire to clear understory species and facilitate recruitment. However, these sites can be pre-empted by saltcedar as it rapidly recovers after fire. The ladder fuel saltcedar creates can also carry fire into the crown of Washington fan palms, increasing the incidence of crown fires lethal to other species.

Native Uncharacteristic Conditions

Canopy cover can reach 100% in classes B and C.

Scale Description

These systems exist as small linear features <60m wide in the landscape. Flash flooding will disturb miles of riparian vegetation, whereas fires may burn <100ac in long linear patches.

Issues/Problems

Comments

BpS 1411552 was split from 1411550 by Louis Provencher (lprovencher@tnc.org) at the request of the

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Missoula Fire Lab. This version of the model is restricted to stringers; therefore the Native American influence on fire regimes, farming and wood collection was removed, A longer FRI of 500-1000yrs was retained. The system is nearly entirely dependent on flash flooding.

BpS 1411550, now 1411551, was originally created by Matt Brooks (matt_brooks@usgs.gov) and Louis Provencher (lprovencher@tnc.org) and substantially revised with the input of several reviewers: Kay Fowler (csfowler@scs.unr.edu), Amadeo M. Rea (San Diego SU), Janet Grove (jgrove@fs.fed.us), Holly Richter (hrichter@tnc.org), Jony Cockman (jcockman@blm.gov), Julie Stromberg (jstrom@asu.edu) and Brooke Gebow (bgebow@tnc.org). All reviewers, except Kay Fowler, Amadeo Rea and Julie Stromberg participated in modeling at TNC's Ramsey Canyon Preserve, AZ on 9/18/05.

Following further discussions with Jeri Kruger (jkruger@fws.edu), Julie Stromberg and literature reviews, Louis Provencher (lprovencher@tnc.org) modified the model by adding a fifth class resulting from stand replacement fire that does not cause cottonwood and willow germination because this case is not associated with flooding. Many changes were done to the original model by M. Brooks. Floods causing stand replacing events were more frequent (5-50yrs, 50yrs+, for respectively, mid- and late-development classes). Classes C and D in 1411551 were merged into new class D (mature cottonwood and willow; still accounting for Native American influences). Class E was added for mesquite bosque, which is the last successional phase in the floodplain, with 500yr flood events and replacement fire every 250yrs on average; and, although Native American influences were maintained, the importance of mixed severity was implicitly reduced by removing time since disturbance from the original BpS. In the original model, and it's revision from 9/18/05, replacement fire was assumed to cause a return to class A, which is impossible. Class A is only the result of stand replacing flood events where cottonwood and willow germination is possible. Replacement fire does not change the elevation of a terrace or create a seedbed for willows and cottonwoods, but allows resprouting and seed establishment by mesquite and other shrubs (eg, Salix gooddingii). Therefore, class C is the recipient of all replacement fire and will eventually succeed to mesquite bosque unless a 50yr flood event scours the more fragile soils of class C. To accommodate the LANDFIRE (LF) limit for one early S-Class, class C starts at age one and is considered mid-development. In reality, class C behaves as an alternative early-development class.

One reviewer suggested several changes to clarify the geographic location of the BpS, its elevation and species/patch composition. The reviewer indicated that presettlement warm desert riparian systems were very patchy (Jeri Krueger from FWS NV forwarded accounts from early explorers of the Virgin River that support the patchy nature of the vegetation and importance of mesquite) and probably contained more grasslands and shrub patches that we find today, and therefore, may have supported a greater amount of fine fuels and fire. These issues were addressed, although the fire frequency was not changed as it is frequent enough in the current version. The reviewer also recommended adding references on southwestern riparian systems by Busch, Ellis and Davis, which was done.

Native American burning was introduced as a very plausible disturbance. However, no data or expertise were available at the creation of the original model. Reviews by ethnobiologists Kay Fowler and Amadeo Rea resulted in important modifications to the original model and description (Fowler 2003; Rea 1983). 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 all mid-development and late-development classes (except mesquite bosque, class E), and farming and fuel collection were added, respectively, as model parameters in early and late-development open classes. Amadeo Rea explained that warm desert rivers of MZ14 and

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MZ15 were more heavily farmed by the Pimans Indian than those of MZ13 (Mohave and Shoshone Indians) (also suggested by Dr. Fowler). In all cases, he agreed that Native people probably modified the vegetation structure and composition of warm desert river floodplains far more than currently understood. Dr. Rea also explained that Native burning was used to flush rodents, even more than jackrabbits, and that fire was avoided in mesquite bosque, in cultivated fields and near fences. Burning was especially intense in riparian grasslands dominated by Sporobolus spp, marshes and shrubby areas.

As part of LF re-mapping of 8 western MZs 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.

Vegetation Classes

Class A 15 %

Early Development 1 All Structure

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model

8

Indicator Species and Canopy Position

SAGO Upper
PROSO Upper
DISP Lower
SPAI Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	50 %
Height	Shrub 0.6m	Shrub 1.0m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Immediate post-disturbance responses are dependent on pre-disturbance vegetation composition. Salix gooddingii and Populus fremontii favored by flooding, whereas Salix, mesquite and graminoids are favored by fire. This class is typically shrub/seedling dominated, but graminoids may co-dominate.

Generally, this class is expected to occur 1-5yrs post-disturbance. Modeled disturbances include stand-replacing flood events for herbaceous vegetation and seedlings approximately every 7yrs and 20yr flood events that remove shrubs and small trees.

Transition to Class B after five years.

Class B 30 %

Mid Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model

8

Indicator Species and Canopy Position

SAGO Upper
POFR2 Upper
PROSO Lower
FRVE2 Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	51 %	100 %
Height	Shrub 1.1m	Shrub >3.1m
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, maybe cottonwoods if surface water is present) with patches of graminoids and halophytic shrubs. Modeled disturbances include 20yr flooding events on mid-level terraces causing stand replacement and 7yr events than maintain the stand in class B. The FRI of replacement fire is 1000yrs. This class is an ideal bed

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for mesquite germination and establishment. Succession to class C after 15yrs.

Class C **55 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

8

Indicator Species and Canopy Position

PROSO
Middle
SAGO
Upper
ACACI
Middle
FRVE2
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	51 %	100 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

This class represents the mature cottonwood, if surface is present, acacia, mesquite and willow riparian woodlands with patches of graminoids in saturated soils and of halophytic shrubs on drier sediment deposits or saltier surfaces. Stand replacement is caused by 50yr flooding events and rare wildfire (mean FRI of 500yrs). 20yr flood events remove shrubs and small trees in the mid-story and understory and maintain vegetation in class C.

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

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

Fuel Model

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.

Description

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

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

Fuel Model

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.

Description

Disturbances

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Fire Regime Group:** V

Historical Fire Size (acres)

Avg 50
Min 1
Max 100

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	*Avg FI*	*Min FI*	*Max FI*	*Probability*	*Percent of All Fires*
Replacement	666	500	1000	0.00150	99
Mixed					
Surface					
All Fires	665			0.00152	

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
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Brooks, M.L. and R.A. Minnich. In Press. Fire in the Southeastern Desert Bioregion. Chapter 16 in: N.G. Sugihara, J.W. van Wagtendonk, J. Fites-Kaufman, K.E. Shaffer and A.E. Thode, eds. Fire in California ecosystems. University of California Press, Berkeley.

Busch, D.E. and S.D. Smith. 1995. Mechanisms associated with decline of woody species in riparian ecosystems of the southwestern U.S. Ecological Monographs 6: 347-370.

Davis, G.A. 1977. Management Alternatives for Riparian Habitat in the Southwest; Importance, Preservation and Management of Riparian Habitat: A Symposium July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43. 59-67. 19 ref.

Ellis, L.M. 1995. Bird use of Salt cedar and Cottonwood vegetation in the Middle Rio Grande Valley of New Mexico, U.S.A.. Journal of Arid Environments, Department of Biology, University of New Mexico, Albuquerque, NM. 339-349.

Ellis L.M. 2001. Short-term response of woody plants to fire in a Rio Grande riparian forest, Central New Mexico, USA. Biological Conservation 97: 159-170.

Ellis, L.M., C.S. Crawford and M.C. Molles, Jr., 1996. The middle Rio Grande bosque: an endangered ecosystem. New Mexico Journal of Science 36.

Ellis, L.M., C.S. Crawford and M.C. Molles, Jr., 1997. Rodent communities in native and exotic riparian vegetation in the Middle Rio Grande Valley of central New Mexico. The Southwestern Naturalist 42: 13-19.

Ellis, L.M., C.S. Crawford and M.C. Molles, Jr., 1998. Comparison of litter dynamics in native and exotic riparian vegetation along the middle Rio Grande of central New Mexico, U.S.A. Journal of Arid Environments 38: 283-296.

Ellis, L.M., C.S. Crawford and M.C. Molles, Jr., 2002. The Role of the Flood Pulse in Ecosystem-Level Processes in Southwestern Riparian Forests: A Case Study from the Middle Rio Grande. Pages 51-107 in:

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B.A. Middleton, ed. Flood Pulsing in Wetlands: Restoring the Natural Hydrological Balance, John Wiley and Sons, Inc.

Fowler, C.S, P. Esteves, G. Goad, B. Helmer and K. Watterson. 2003. Caring for the Trees: Restoring Timbisha Shoshone Land Management Practices in Death Valley National Park. Ecological Restoration 21: 302-306.

Molles, M.C. Jr., C.S. Crawford, L M. Ellis, H.M. Valett and C.N. Dahm. 1998. Managed Flooding for Riparian Ecosystem Restoration. Bioscience 48: 749-756.

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

Rea, A.M. 1983. Once a river; Bird life and habitat changes on the middle Gila. University of Arizona Press.

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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