

Monitoring Program for Science-Based Adaptive Management Motion
MSCP-IA Committee
November 17, 2005

Pima County should adopt the following memorandum language for use in development of a monitoring program as part of the PCMSCP.

17 November 2005

To: Multi-Species Habitat Conservation Plan Implementation Agreement Committee

From: Bill Shaw, Chair, Science TAT, Chair, Science Commission
Bob Steidl, Vice-Chair, Science TAT, Science Commission
Rob Marshall, MSHCP-IA Committee
Tom Sheridan, Chair, Ranch Conservation TAT, Science Commission
Bill Arnold, MSHCP-IA Committee
Carolyn Campbell, MSHCP-IA Committee

Re: Monitoring Program for Science-Based Adaptive Management

We believe that the success of Pima County's Sonoran Desert Multi-Species Habitat Conservation Plan depends upon the development and implementation of a monitoring program to inform and guide adaptive management over the course of the Section 10 permit. To do so, such a monitoring plan needs to:

- 1) Provide reliable information. This means that the program must be based on a rigorous, probabilistic sampling design established throughout Pima County, both within and outside of the Conservation Lands System.
- 2) Be focused on a set of monitoring parameters that are carefully chosen to provide cost-effective information on the types, rate, and direction of changes in biotic and abiotic resources, including the human footprint.
- 3) Be established with a dedicated funding source that enables the County to implement the program in a timely and consistent fashion over the lifespan of the Section 10 permit.

Monitoring all species being considered for coverage under the Section 10 permit would be infeasible for any jurisdiction. Therefore, we propose that for the first five years of the permit, the monitoring program be designed to focus on a limited set of monitoring parameters as an initial guide for adaptive management:

- 1) **Land cover** based on remote-sensing data to track the magnitude and spatial distribution of change in the major land-use and land-cover types throughout the

County. This should be measured annually and should include coverages of vegetation communities;

- 2) **Vegetation composition** in key plant communities based on ground-based sampling. This should be measured every 3-5 years and include semi-desert grasslands and saguaro-mixed cactus associations because of their national and local significance. Monitoring parameters should include species composition and coverage of native and nonnative perennial grasses, shrubs, and trees sampled throughout the County. The sampling strategy could incorporate existing monitoring programs such as those carried out by the Natural Resources Conservation Service on private lands as long as they meet the necessary criteria;
- 3) **Landbirds, aquatic vertebrates, and selected species.** Monitor distribution and abundance of selected species known to track environmental changes closely, and are cost-effective to monitor;
- 4) **Riparian and groundwater resources.** Compile information available from groundwater wells, stream flow, etc. Special Elements, including perennial streams, should receive particular attention as most of the vulnerable species in the County are aquatic or have riparian associations;
- 5) **A suite of leading social and economic indicators**, most of which should be available free, including size of the human population in the County, number of building permits issued, and other relevant socio-economic indicators.

A novel and essential element of the strategy outlined above is that the monitoring program itself be adaptive. Therefore, over the course of the Section 10 permit, we anticipate that the monitoring program will be refined, and as information is generated, it should be used to refine the sampling design. This will likely include changes in the number and type of monitoring parameters and the frequency with which they are measured.

To guide future conservation and management activities effectively and consistently, a detailed monitoring program needs to be developed and implemented as part of the MSCP. This monitoring plan should be in place and funded before the Section 10 permit is issued, with a framework outlined in the permit application available for public review.

Lastly, cost-effectiveness and scientific robustness are not mutually exclusive in development of a monitoring program. Nonetheless, designing such a program will require careful analysis of monitoring alternatives so far as what to monitor and why to monitor it, because even the initial monitoring program must be scientifically credible for adaptive management to be meaningful.

Draft Species Conditions for Needle-spined Pineapple Cactus (NSPC)
November 28, 2005

These conditions are intended to wholly replace the draft conditions presented to STAT on August 30, 2005 by RECON. The activities proposed include acquisition (1-2), inventory/management/monitoring (3-4), regulation (5-7), and coordination with others (8-9).

1. Pima County will continue to acquire additional areas of NSPC habitat necessary to offset impacts of urbanization. Acquisitions are defined as fee ownership and conservation easements. Habitat is defined as areas within high or medium potentially suitable habitat in the MSCP.
2. Potential acquisitions in known range of NSPC with medium to high potential habitat as defined by RECON's habitat model will be surveyed for presence of the species and its habitat as part of the negotiations (pre-closing), unless precluded by the property owner.
3. NSPC habitat and individual specimen survey data will be used to develop management and monitoring needs for acquired properties.
4. Management plans and master plans for County-owned open space lands in the PCA of the species will include measures to avoid and minimize impacts to the species on those lands that we own.
5. Pima County will use the NPPO and CLS guidelines as a tool to achieve conservation of the NSPC on private property.
6. Pima County proposes to strengthen the NPPO during the first phase of the MSCP to minimize losses due to development on private property. Revisions will attempt to conserve habitat and connectivity based on best available science. Specific revisions will identify where on-site, off-site and combinations of on-site and offsite mitigation may be applied.
7. During first phase of the permit, other development-related regulations that require open space set-asides will be evaluated, and revised where appropriate, to augment conservation for NSPC.
8. Pima County Public Works will conduct a programmatic review of the cumulative impacts of the Capital Improvement Program and infrastructure maintenance programs. Impacts thought to be adverse to this species will be described. Measures to avoid and minimize will be proposed in the programmatic review, and incorporated into concept and final designs by the project managers. Where avoidance and minimization efforts cannot be achieved, then mitigation will be implemented by the departments.

9. Pima County will explore partnerships with developers and ranchers to jointly achieve conservation of NSPC.

Draft Species Conditions for Pima pineapple cactus (PPC)
November 28, 2005

These conditions are intended to wholly replace the draft conditions presented to STAT on August 30, 2005 by RECON. The activities proposed include acquisition (1-2), inventory/management/monitoring (3-6), regulation (7-10), and coordination (10-13).

1. Pima County will continue to acquire additional high value areas necessary to offset impacts of urbanization on PPC. Acquisitions are defined as fee ownership and conservation easements.

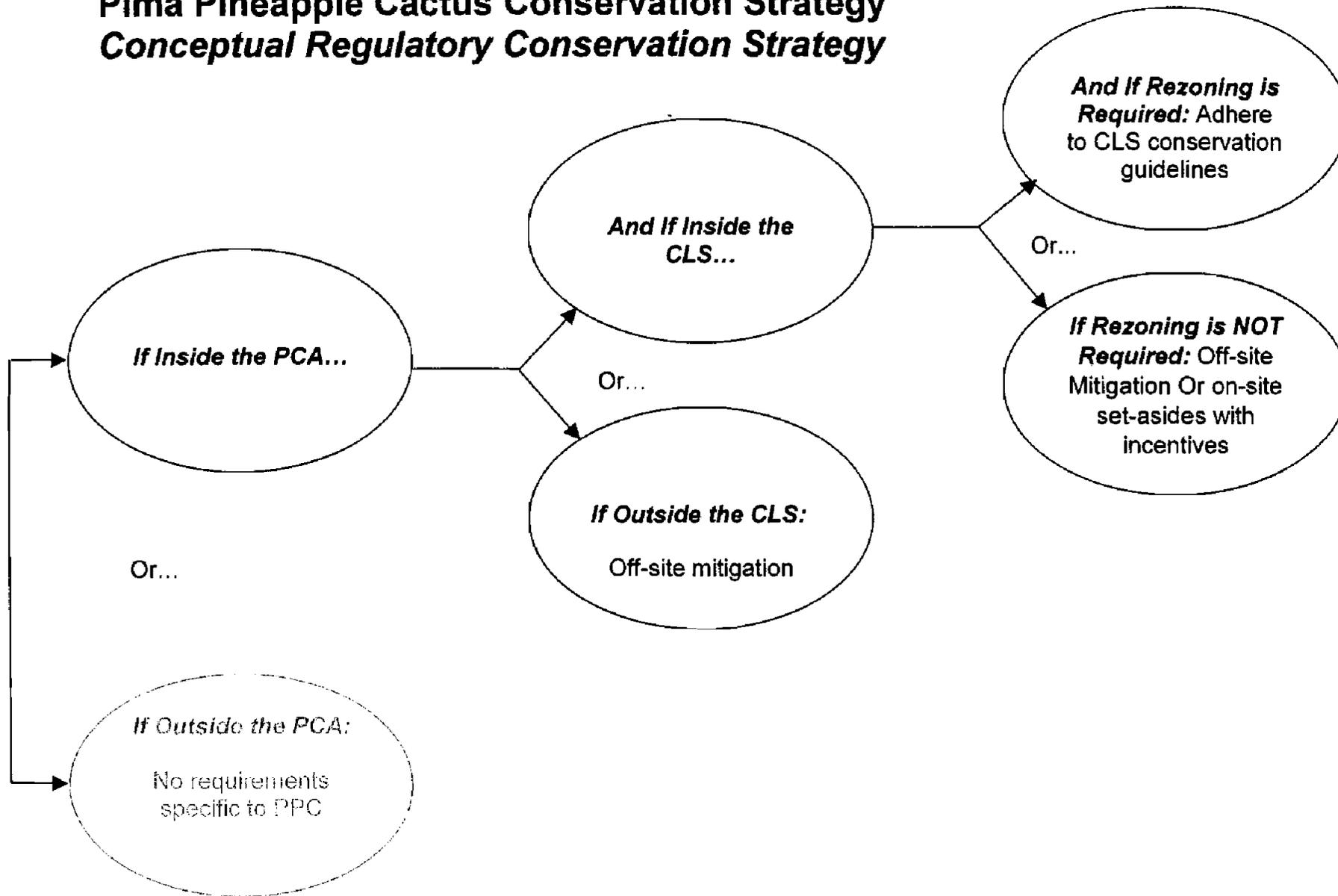
High value areas are those areas that include one or more of the following with regard to PPC:

- = Average to above average densities, and
 - = Are either inside or outside PCA, and
 - = Sizeable enough to provide sustained conservation value,
or
 - = Have been identified by STAT as preferred locations for PPC Conservation, or
 - = Provide/augment connectivity to existing reserves
2. Potential acquisitions in known range of PPC as defined by RECON's habitat model will be surveyed for the species and its habitat as part of the negotiations (pre-closing), unless precluded by the property owner.
 3. Management plans and master plans for County-owned open space lands in the PCA of the species will include measures to avoid and minimize impacts to the species on those lands that we own.
 4. PPC habitat and individual specimen survey data will be used to develop management and monitoring needs for acquired properties.
 5. Pima County will survey in areas south of the Sierrita Mountains and west of Interstate 19, where permission is granted, in an attempt to verify that additional PPC locations exist.
 6. Pima County will encourage studies and other scientific investigations for PPC that are designed to increase knowledge about habitat/connectivity requirements and/or evaluate the effectiveness of conservation strategies including, but not limited to, transplant methodologies and set-asides within subdivisions.
 7. Pima County will use the NPPO and CLS guidelines as tools to achieve conservation of the Pima pineapple cactus associated with the development of private property.

8. Pima County proposes to strengthen the NPPO *within the first 3 years following permit issuance* of the MSCP to minimize losses of PPC and habitat due to development on private property. Revisions will *focus on the* conservation of PPC habitat and landscape connectivity *and will be based on the* best available science. Specific revisions will identify where on-site, off-site and combinations of on-site and offsite mitigation may be applied.
9. During the first phase of the permit, other development-related regulations that require open space set-asides (e.g., *Conservation Subdivision Ordinance, Buffer Overlay Zone Ordinance, Cluster Development Option*) will be evaluated, and revised where appropriate, to augment conservation for the Pima pineapple cactus.
10. Pima County will establish or work with private landowners to establish mitigation banks that will be available for use by the private and public sector. The NPPO will be revised to allow the purchase of credits in a bank to offset impacts to this species.
11. Pima County Public Works will conduct a programmatic review of the cumulative impacts of the Capital Improvement Program and infrastructure maintenance programs by the end of year two. Impacts thought to be adverse to this species will be described. Measures to avoid and minimize will be proposed in the programmatic review, and incorporated into concept and final designs by the project managers. Where avoidance and minimization efforts cannot be achieved, then mitigation will be implemented by the departments in advance of the projects.
12. Pima County will explore partnerships with developers and ranchers to jointly achieve conservation of PPC.
13. Pima County will encourage and cooperate in a combined effort with the City of Tucson, Town of Sahuarita, and the State Land Department to develop a multi-jurisdictional approach to conservation of these species on lands subject to each respective jurisdiction. The focus of the PPC effort will be the preservation of connectivity between known populations of PPC in the Altar Valley and the Santa Rita piedmont.

Pima Pineapple Cactus Conservation Strategy

Conceptual Regulatory Conservation Strategy



Vegetation in Pima County by GAP Status 1-3 for 1998 and 2005

Table 1: Percent of Conserved Vegetation by Category

Category	1998 Total Acres In GAP Status 1-3	1998 Percent In Conservation	2005 Total Acres in GAP Status 1-3	2005 Percent in Conservation	Total Acres In Pima County
Biome (Series)					
Sonoran Riparian Woodland (Mesquite)	582.21	99.8%	582.82	99.8%	583.09
Sonoran Riparian and Oases Forests (Mesquite)	5,707.70	21.6%	6,887.78	26.0%	26,489.21
Sonoran Riparian and Oases Forests (Cottonwood - Willow)	2,070.83	61.0%	2,193.42	64.4%	3,404.58
Sonoran Interior Strand (Annual)	0.00	0.0%	0.00	0.0%	109.23
Sonoran Interior Strand	296.67	5.7%	986.22	18.9%	5,221.38
Sonoran Interior Marshland (Saltgrass)	85.37	99.0%	86.32	100.0%	86.32
Sonoran Interior Marshland (Cattail)	20.34	70.6%	21.63	75.1%	28.80
Interior SW Riparian Deciduous Forest and Woodland (Mixed Broadleaf)	949.69	83.6%	1,002.65	88.3%	1,135.37
Interior SW Riparian Deciduous Forest and Woodland (Cottonwood-Willow)	0.00	0.0%	5.98	24.0%	29.14
Interior SW Riparian Deciduous Forest and Woodland	4,497.69	76.6%	4,592.26	78.2%	5,871.62
Sonoran Deciduous Swamp and Riparian Scrub (Mixed Scrub)	1,758.30	27.9%	1,869.22	29.7%	6,301.72
Sonoran Deciduous Swamp and Riparian Scrub	534.48	7.6%	1,320.21	18.7%	7,043.44
Agriculture / Developed / Water / Bare Ground (Stream Bed)	114.16	18.1%	410.06	65.1%	629.87
Agriculture / Developed / Water / Bare Ground (Perennial Stream)	1.37	21.6%	3.10	49.0%	6.34
Total for Riparian and Wetland	16,618.80	29.2%	19,962.68	35.1%	66,920.11
Sonoran Desertscrub (Saltbush)	9,943.09	99.8%	9,962.53	100.0%	9,962.61
Sonoran Desertscrub (Paloverde - Mixed Cacti)	471,741.59	15.3%	486,127.78	16.8%	3,084,022.62
Sonoran Desertscrub (Creosote - Bursage)	479,732.72	49.0%	491,784.25	50.3%	978,660.08
Sonoran Desertscrub (Agave - Bursage)	43.62	100.0%	43.62	100.0%	43.62
Sonoran Desertscrub	16,080.89	12.7%	19,718.59	15.5%	126,900.49
Total for Sonoran Desertscrub	977,541.90	23.30	1,007,636.76	24.00	4,199,589.42
Scrub-Grassland (Semidesert Grassland) (Shrub-Scrub Disclimax)	2,125.92	100.0%	2,125.92	100.0%	2,125.92
Scrub-Grassland (Semidesert Grassland)	380,334.57	34.2%	453,118.22	40.7%	1,113,523.38
Total for Scrub-Grassland	382,460.49	34.30	455,244.14	40.80	1,115,649.30
Chihuahuan Desertscrub (Mixed Scrub)	394.00	11.3%	391.65	11.2%	3,494.41
Chihuahuan Desertscrub (Creosotebush - Tarbush)	634.58	6.1%	5,108.63	49.2%	10,384.28
Total for Chihuahuan Desertscrub	1,028.58	7.4%	5,500.28	39.6%	13,878.69
Madrean Evergreen Forest and Woodland	160,972.90	78.0%	162,267.14	78.6%	206,407.88
Interior Chaparral	6,958.80	28.8%	7,100.69	27.3%	25,978.42
Conifer Forest	19,116.26	95.7%	19,150.44	95.9%	19,967.75
Agriculture / Developed / Water / Bare Ground (Water Tank)	5.10	0.7%	5.10	0.7%	738.84
Agriculture / Developed / Water / Bare Ground (Sewage Pond)	0.00	0.0%	0.00	0.0%	10.01
Agriculture / Developed / Water / Bare Ground (Mining Pond)	0.00	0.0%	0.14	0.1%	182.94
Agriculture / Developed / Water / Bare Ground (Lake)	131.46	30.6%	131.52	30.6%	429.81
Agriculture / Developed / Water / Bare Ground (Developed)	1,225.14	0.7%	1,258.73	0.8%	165,963.57
Agriculture / Developed / Water / Bare Ground (Agriculture - Abandoned)	72.90	0.4%	153.21	0.8%	19,704.07
Agriculture / Developed / Water / Bare Ground (Agriculture - Active)	852.33	1.6%	2,236.54	4.1%	54,231.77
Total for Agriculture/Developed/Water/Bare Ground	2,286.92	1.0%	3,785.23	1.6%	241,181.01
GRAND TOTAL	1,566,984.64		1,680,647.36		5,879,572.58

Vegetation in Pima County by GAP Status 1-3 for 1998 and 2005

Table 2: Percentages of Total Conserved Acres

Biome (Series)	1998 Total Acres In GAP Status 1-3	1998 Percent of Total Conservation Acres	2005 Total Acres in GAP Status 1-3	2005 Percent of Total Conservation Acres	Total Acres in Pima County	Total Percent of Pima County
Sonoran Riparian Woodland (Mesquite)	582.21	0.04%	582.82	0.03%	583.09	< 0.01%
Sonoran Riparian and Oases Forests (Mesquite)	5,707.70	0.36%	6,887.78	0.41%	26,469.21	0.50%
Sonoran Riparian and Oases Forests (Cottonwood - Willow)	2,070.83	0.13%	2,193.42	0.13%	3,404.58	0.06%
Sonoran Interior Strand (Annual)	0.00	0.00%	0.00	0.00%	109.23	< 0.01%
Sonoran Interior Strand	296.67	0.02%	986.22	0.06%	5,221.38	0.09%
Sonoran Interior Marshland (Saltgrass)	85.37	0.01%	86.32	0.01%	86.32	< 0.01%
Sonoran Interior Marshland (Cattail)	20.34	0.00%	21.63	0.00%	28.80	< 0.01%
Sonoran Desertscrub (Saltbush)	9,943.09	0.63%	9,962.53	0.59%	9,962.61	0.17%
Sonoran Desertscrub (Paloverde - Mixed Cacti)	471,741.59	30.11%	486,127.78	28.93%	3,084,022.62	52.50%
Sonoran Desertscrub (Creosote - Bursage)	479,732.72	30.62%	491,784.25	29.26%	978,660.08	16.70%
Sonoran Desertscrub (Agave - Bursage)	43.62	< 0.01%	43.62	0.00%	43.62	< 0.01%
Sonoran Desertscrub	16,080.89	1.03%	19,718.59	1.17%	126,900.49	2.20%
Sonoran Deciduous Swamp and Riparian Scrub (Mixed Scrub)	1,758.30	0.11%	1,869.22	0.11%	6,301.72	0.11%
Sonoran Deciduous Swamp and Riparian Scrub	534.48	0.03%	1,320.21	0.08%	7,043.44	0.12%
Scrub-Grassland (Semidesert Grassland) (Shrub-Scrub Disclimax)	2,125.92	0.14%	2,125.92	0.13%	2,125.92	0.04%
Scrub-Grassland (Semidesert Grassland)	380,334.57	24.27%	453,118.22	26.96%	1,113,523.38	18.94%
Madrean Evergreen Forest and Woodland	160,972.90	10.27%	162,267.14	9.66%	206,407.88	3.51%
Interior SW Riparian Deciduous Forest and Woodland (Mixed Broadleaf)	949.68	0.06%	1,002.65	0.06%	1,135.37	0.02%
Interior SW Riparian Deciduous Forest and Woodland (Cottonwood-Willow)	0.00	0.00%	6.98	0.00%	29.14	< 0.01%
Interior SW Riparian Deciduous Forest and Woodland	4,497.69	0.29%	4,592.26	0.27%	5,871.62	0.10%
Interior Chaparral	6,958.80	0.44%	7,100.69	0.42%	25,978.42	0.44%
Conifer Forest	19,116.26	1.22%	19,150.44	1.14%	19,967.75	0.34%
Chihuahuan Desertscrub (Mixed Scrub)	394.00	0.03%	391.65	0.02%	3,494.41	0.06%
Chihuahuan Desertscrub (Creosotebush - Tarbush)	634.58	0.04%	5,108.63	0.30%	10,384.28	0.18%
Agriculture / Developed / Water / Bare Ground (Water Tank)	5.10	0.00%	5.10	0.00%	738.84	< 0.01%
Agriculture / Developed / Water / Bare Ground (Stream Bed)	114.16	0.01%	410.06	0.02%	629.87	< 0.01%
Agriculture / Developed / Water / Bare Ground (Sewage Pond)	0.00	0.00%	0.00	0.00%	10.01	< 0.01%
Agriculture / Developed / Water / Bare Ground (Perennial Stream)	1.37	0.00%	3.10	0.00%	6.34	< 0.01%
Agriculture / Developed / Water / Bare Ground (Mining Pond)	0.00	0.00%	0.14	0.00%	102.94	< 0.01%
Agriculture / Developed / Water / Bare Ground (Lake)	131.46	0.01%	131.52	0.01%	429.81	< 0.01%
Agriculture / Developed / Water / Bare Ground (Developed)	1,225.14	0.08%	1,258.73	0.07%	165,963.57	2.82%
Agriculture / Developed / Water / Bare Ground (Agriculture - Abandoned)	72.90	0.00%	153.21	0.01%	19,704.07	0.34%
Agriculture / Developed / Water / Bare Ground (Agriculture - Active)	852.33	0.05%	2,236.54	0.13%	54,231.77	0.92%
Grand Total	1,566,984.64	26.70%	1,680,647.36	28.68%	5,879,572.58	100.00%

Table 3: High Quality Grasslands within Reserves

1998 High Quality Grasslands Within Reserves

(note: CLASS = A or B or A&B or DEFINITION = native grass dominated; less than 10% shrub or DEFINITION = Sacaton riparian grassland)

RESERVE 12	CLASS	DEFINITION	Acres
BUENOS AIRES WILDLIFE REFUGE	C	Sacaton riparian grassland	3,073.49
CORONADO NATIONAL FOREST	A & B	A B mosaic	10,444.70
CORONADO NATIONAL FOREST	A	Native grass dominated; less than 10% shrub cover	6,182.21
EMPIRE-CIENEGA RCA	A & B	A B mosaic	2,842.13
EMPIRE-CIENEGA RCA	A	Native grass dominated; less than 10% shrub cover	24,474.85
EMPIRE-CIENEGA RCA	C	Sacaton riparian grassland	220.40
SANTA RITA EXP RANGE	A	Native grass dominated; less than 10% shrub cover	1.04
Total High Quality Grassland Acres			47,238.83

2005 High Quality Grasslands within Reserves

RESERVE	CLASS	DEFINITION	Acres
BUENOS AIRES NATIONAL WILDLIFE REFUG	C	Sacaton riparian grassland	3,080.50
CORONADO NATIONAL FOREST	A & B	A B mosaic	10,551.99
CORONADO NATIONAL FOREST	A	Native grass dominated; less than 10% shrub cover	6,154.22
LAS CIENEGAS NATIONAL CONSERVATION	A	Native grass dominated; less than 10% shrub cover	2,100.08
LAS CIENEGAS NATIONAL CONSERVATION	C	Sacaton riparian grassland	199.45
LAS CIENEGAS NATIONAL MONUMENT	A & B	A B mosaic	2,842.13
LAS CIENEGAS NATIONAL MONUMENT	A	Native grass dominated; less than 10% shrub cover	24,474.85
LAS CIENEGAS NATIONAL MONUMENT	C	Sacaton riparian grassland	220.40
RANCHO SECO	C	Sacaton riparian grassland	40.84
SANTA RITA EXP RANGE	A	Native grass dominated; less than 10% shrub cover	1.17
Total High Quality Grassland Acres			49,665.63

Percentage of High Quality Grasslands in Reserves		
	1998 Acres	2005 Acres
Scrub Grassland (Semidesert Grassland)	380,334.57	453,118.22
High Quality Grasslands	47,238.83	49,665.63
Percent of High Quality grasslands conserved within Scrub Grassland	12.40%	11%