

# Comparing Perceptions *of Native Status*



*A seed production field of P-7 bluebunch wheatgrass (*Pseudoroegneria spicata* (Pursh) A. Löve [Poaceae]) germplasm, an example of a multiple-origin polycross. Should it, or cultivars of native plants, still be considered native?*

Photo by DC Nielson

STEVEN E SMITH AND SUSAN R WINSLOW

## ABSTRACT

Use of the term “native” when referring to plants is common in many settings. However, what “native” means to different individuals and groups is often poorly understood. Inconsistent definition of native status (“nativity”) may complicate implementation or endorsement of conservation activities, particularly those involving revegetation. Professionals in plant-related fields are typically responsible for developing revegetation projects as well as regulations that apply to these projects. To assess how definition criteria may differ between groups we developed a questionnaire that asked respondents to assess native status in 13 hypothetical revegetation scenarios. A total of 303 questionnaires were evaluated with respondents from 33 states. Different respondent groups responded differently in certain scenarios. Where differences existed, professionals in plant-related fields were more likely to regard plants native than non-professionals. Respondents associated with Native Plant Societies (NPS) were less likely to designate plants as native than non-NPS respondents. Successful conservation activities with native plants should involve open and precise definition of nativity.

**KEY WORDS:** grassland, indigenous species, restoration, revegetation

**NOMENCLATURE:** USDA NRCS (1999)

With increasing interest in such topics as ecological integrity, biological diversity, and invasive species (Lemons and others 1998; Westbrooks 1998), land managers, resource extractors, scientists, legislators, and members of the public frequently find themselves engaged in discussions of scientifically complex issues. During discussions that involve native plants, critical terminology and biological principles may be formally stated and accepted without complete review. Unfortunately, when such exchanges lack effective examination of fundamental scientific considerations, misunderstanding and emotion can prevail over comprehension and logic. This can lead to policies and regu-

TABLE 1

*Representative definitions of native plant species*

Definition	Source	Reference <sup>a</sup>
"A species which is part of the original fauna or flora of the area in question."	Society for Range Management	Society for Range Management 1989
"...plants that were growing in the United States before human settlement."	Center for Plant Conservation	<a href="http://www.mobot.org/CPCI/faq.html">http://www.mobot.org/CPCI/faq.html</a>
"...any plant which is a member of a species which was present at a given site prior to European contact."	California Native Plant Society	<a href="http://www.cnps.org/archives/exotics.htm">http://www.cnps.org/archives/exotics.htm</a>
"...with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem."	Executive Order on Invasive Species, February 1999	<a href="http://www.nps.gov/plants/alien/press/eo.htm">http://www.nps.gov/plants/alien/press/eo.htm</a>
"...one that occurs in a particular region, ecosystem, and habitat without direct or indirect human actions. Species native to North America are generally recognized as those occurring on the continent prior to European settlement."	Plant Conservation Alliance	<a href="http://www.nps.gov/plants/alien/bkgd.htm">http://www.nps.gov/plants/alien/bkgd.htm</a>
"...occurs and evolves naturally without human intervention or manipulation. Species that move into an area without the direct or indirect aid of humans are considered native . . ."	National Park Service	<a href="http://www2.nature.nps.gov/nps77/exotic.new.html#DEF">http://www2.nature.nps.gov/nps77/exotic.new.html#DEF</a>
[for Britain] "...one which evolved in these islands or which arrived there by one means or another before the beginning of the neolithic period [ca. 8000-2700 B.C.], or which arrived there since that date by a method entirely independent of human activity."	DA Webb	Webb 1985

<sup>a</sup> All Internet sites accessed 21 April 2000.

lations that are so scientifically unsound or ambiguous that they are exceedingly difficult to implement (Richards and others 1998) or are not accepted by all parties involved.

Given its importance and widespread recognition, the term "native" (considered synonymous here with "indigenous") is prominent in many discussions of natural resource policy and management (Brown and Amacher 1999). While a wide range of definitions of native status ("nativity") exist (Table 1), "native" is frequently used without explicit definition (for example, USDA NRCS [1999]). This inconsistent and sometimes careless usage continues despite comprehensive descriptions of the scientific and practical issues involved in designating nativity (Webb 1985; Mackenzie 1989;

Schwartz 1997). Moreover, essential components of most stated definitions include terms such as "ecosystem" or "species" that themselves may be difficult to define unambiguously (Schwartz 1997). Our experiences with both professionals working with plants as well as non-professionals suggest that criteria for designation of native status may also differ significantly between these groups. If this is true, then it may be difficult for non-professionals to understand and accept scientific findings, policies, and regulations related to native plants (for example, City of Tucson [1997]). Implementation of revegetation projects is one instance where differences in designation of nativity is most problematic.

To facilitate a better understanding of accepted criteria for the definition of nativity among different groups, we developed a questionnaire that asked respondents to evaluate native status in several hypothetical revegetation scenarios. These scenarios were designed to reflect real-world conditions confronted by those attempting to implement revegetation projects while meeting requirements for native plant use. Our hypothesis was that because of their scientific backgrounds, professionals who regularly work with plants (for example, resource manager, scientist, plant producer) would tend to define nativity differently than non-professionals (for example, home-maker, English teacher, stock broker, artist).

## MATERIALS AND METHODS

Our questionnaire asked respondents to determine nativity in 13 revegetation scenarios each of which had the goal of restoring a disturbed grassland community. In each scenario (Table 2), seeds of a perennial grass species (Table 3) commonly found within the state where respondents resided or worked were harvested from a particular site for use in a revegetation activity. At least 1 cultivar is available for each of the species. Scenarios were designed to address various concerns encountered when determining the native

status of potential seed sources for revegetation projects. For each scenario, respondents could answer whether the plants resulting from the seeds were native, not native, or if the respondent was unsure. Two scenarios (12 and 13) dealt with seeds that originated in Mexico and were constructed to assess attitudes related to political boundaries; only responses from states that border Mexico were considered. Respondents were asked to estimate the percentage of their time spent working with plants and to describe their occupation or vocation. They also had the opportunity to provide comments on the questionnaire. All responses were voluntary and anonymous.

Printed versions of the questionnaire were distributed to Native Plant Society (NPS) members or chapters in Arizona, Florida, Montana, Oregon, Texas, and Wyoming, either because their addresses were easily accessible from Internet sites or because we were acquainted with persons in the chapters. We also made the questionnaire available on an Internet site and notified potential respondents in specific groups via electronic mail (Table 4).

Respondents were classified as "professional" if their occupation was one that directly involved plants. This includes occupations in fields within agriculture, biology, environmental science, horticulture, land planning or management, or education in any of these areas. All other respondents were classified as "non-professionals." We assumed that respondents classified as professionals had either some post-secondary education in biology or extensive work experience with plants or in biological fields. Responses of individuals classified as non-professionals may represent a sample of attitudes of the general public, although because they had access to this questionnaire and most were NPS members, they may be better informed regarding biological issues than the public at large.

Independence of the responses of treatment groups (for example, professionals versus non-professionals) was determined by generating 2 X 3 cross tabulation tables and calculating G-tests of independence as the experiment fit a Model I sampling procedure (Sokal and

TABLE 2

*Revegetation scenarios described in the native status questionnaire and the particular environmental or management factor(s) considered in each*

<p><b>Scenario: 1 • Description of seed collection site:</b> An undisturbed plant community with the same native vegetation (grassland) that is located less than 1 mile <sup>a</sup> from and on a similar soil as the planting site.  <b>Factor considered:</b> None</p>
<p><b>Scenario: 2 • Description of seed collection site:</b> An undisturbed plant community with the same native vegetation (grassland) that has been regularly grazed by cattle and is located less than 1 mile from and on a similar soil as the planting site.  <b>Factor considered:</b> Grazing</p>
<p><b>Scenario: 3 • Description of seed collection site:</b> An undisturbed plant community with the same native vegetation (grassland) that is located less than 1 mile from but on a different soil as the planting site.  <b>Factor considered:</b> Different soil</p>
<p><b>Scenario: 4 • Description of seed collection site:</b> A previously revegetated roadside surrounded by the same native vegetation (grassland) that is located less than 1 mile from and on a similar soil as the planting site. Seed source used in previous revegetation is unknown.  <b>Factor considered:</b> Previous revegetation</p>
<p><b>Scenario: 5 • Description of seed collection site:</b> An undisturbed plant community with different native vegetation (oak woodland) that is located less than 1 mile from and on a similar soil as the planting site.  <b>Factor considered:</b> Different native vegetation</p>
<p><b>Scenario: 6 • Description of seed collection site:</b> An undisturbed plant community with the same native vegetation (grassland) that is located between 1 and 10 miles from and on a similar soil as the planting site.  <b>Factor considered:</b> Distance (1.6 to 16 km)</p>
<p><b>Scenario: 7 • Description of seed collection site:</b> An undisturbed plant community of the same native vegetation (grassland) that is located between 1 and 10 miles from and on a similar soil as the planting site but at a higher elevation.  <b>Factors considered:</b> Distance (1.6 to 16 km) and elevation</p>
<p><b>Scenario: 8 • Description of seed collection site:</b> An undisturbed plant community of the same native vegetation (grassland) that is located between 10 and 100 miles (north or south) from and on a similar soil as the planting site.  <b>Factor considered:</b> Distance (16 to 160 km)</p>
<p><b>Scenario: 9 • Description of seed collection site:</b> An undisturbed plant community of the same native vegetation (grassland) that is located more than 100 miles (north or south) from and on a similar soil as the planting site.  <b>Factor considered:</b> Distance (&gt; 160 km)</p>
<p><b>Scenario: 10 • Description of seed collection site:</b> A disturbed weedy lot surrounded by the same native vegetation (grassland) that is located less than 1 mile from and on a similar soil as the planting site.  <b>Factor considered:</b> Weediness</p>
<p><b>Scenario: 11 • Description of seed collection site:</b> A commercially available cultivar of this species.  <b>Factor considered:</b> Plant breeding</p>
<p><b>Scenario: 12 • Description of seed collection site:</b> An undisturbed plant community of the same native vegetation (grassland) and climate on a similar soil as the planting site but in Mexico.<sup>b</sup>  <b>Factor considered:</b> From Mexico</p>
<p><b>Scenario: 13 • Description of seed collection site:</b> An undisturbed plant community of the same native vegetation (grassland) that is located less than 1 mile from and on a similar soil as the planting site but that was seeded in 1915 with a collection of this species from Mexico.<sup>b</sup>  <b>Factor considered:</b> From Mexico 84 y ago</p>

<sup>a</sup> English units were used in the questionnaire; 1 mile = 1.61 km.

<sup>b</sup> Only considered relevant for states bordering Mexico.

Rohlf 1995). In cases where the value within a cell of these tables was < 5, 2 X 2 tables were constructed by combining responses for “not native” and “not sure.” Calculations were accomplished using PROC FREQ of SAS (SAS 1989). Standard errors ( $s_x$ ) for proportions were calculated following Fowler (1984). Statistical significance was assigned at  $P \leq 0.05$ .

**RESULTS**

**Sample Characterization**

A total of 303 questionnaires were received with at least one from 33 states (Table 3). A significant proportion (52%) of all respondents were from Florida and Texas because of the many NPS chapters in these states and their Internet accessibility. Questionnaire responses from Florida and Texas were similar to the remainder of NPS responses for all relevant scenarios (1 to 11, data not shown). Among commonly recognized geographical regions in the US, only New England was completely unrepresented.

Overall, professionals in plant-related fields represented 62% of respondents. The mean percentage of time (waking hours per day) spent working with plants in this group was 51% ( $s_x = 2\%$ ) compared with 20% ( $s_x = 2\%$ ) for non-professionals. About two-thirds of all respondents (65%) were NPS

members or located the questionnaire from a NPS Internet site (Table 4). Of these NPS-associated respondents, 49% were classified as professionals while professionals made up the majority (87%) of the 116 non-NPS respondents. Among sources of contact other than NPS, the Society for Range Management (SRM) provided the most significant number of respondents ( $n = 26$ ; Table 4).

**Overall Patterns in Designation of Native Status and Differences among Respondent Groups**

Considering all respondents, the proportion considering seeds described to be native ranged from 17% to 95% across all scenarios (Table 5). The lowest proportion of “native” responses was observed for Scenario 11, which considered planting a cultivar. Based on the percentage of “not sure” responses, uncertainty in designation was greatest for Scenario 4 that involved taking seeds from a previously revegetated site.

Different groups of respondents did respond differently to particular scenarios. Comparing professionals in plant-related fields with non-professionals, responses were significantly different (based on G-tests of independence) for 3 scenarios (1, 2, and 11), with the professionals more often responding that plants would be considered native (Table 6). A total of 33 respondents (25 professional, 8 non-professional) uniformly reported only “native” designations for Scenarios 1 through 11. NPS-associated respondents were also less likely than non-NPS respondents to consider plants native in the target environment if seeds sown came from a different soil (Scenario 3) or was a cultivar (Scenario 11).

Examining only the professionals’ responses (Table 7), those with NPS association were less likely to consider a cultivar native in the target environment than those not associated with a NPS. The tendency towards increased designation as natives among professionals was most pronounced among SRM respondents. This group provided significantly higher proportions of native designations than the remainder of the professionals for 6 scenarios (Table 7). Of the 25 professionals who provided only native designations for Scenarios 1 to 11, 44% ( $n = 11$ ) were associated with SRM. As a group, professional SRM respondents differed from non-professional respondents even more than the entire group of professionals. SRM-associated respondents and non-professionals had significantly different responses on 8 of the first 11 scenarios (2, 3, 5, 7 to 11; data not shown).

Of all responses, 52% were completed using the paper form of the questionnaire and in general the form did not significantly affect response patterns. Professionals had similar responses to the scenarios

**TABLE 3**

*Geographic distribution of respondents and the grass species used in the questionnaire*

<i>Region: species considered in questionnaire</i>	<i>Number of respondents</i>	<i>Percentage of respondents</i>
<b>West and Northwest -</b> Indian ricegrass ( <i>Achnatherum hymenoides</i> (Roemer & J.A. Schultes) Barkworth) CA 13 (4%) <sup>a</sup> ; CO 3 (1%); ID 3 (1%); MT 5 (2%); OR 20 (7%); UT 5 (2%); WA 9 (3%); WY 3 (1%)	61	20
<b>Great Plains and Southwest -</b> sideoats grama ( <i>Bouteloua curtipendula</i> (Michx.) Torr.) AZ 25 (8%); KS 2 (1%); NE 1(0.3%); NM 3 (1%); OK 2 (1%); SD 1 (0.3%); TX 76 (25%)	110	36
<b>East -</b> Switchgrass ( <i>Panicum virgatum</i> L.) AR 1 (0.3%); DE 1 (0.3%); FL 81 (27%); GA 2 (1%); IA 11 (4%); IL 5 (1%); IN 1 (0.3%); KY 1 (0.3%); LA 2 (1%); MD 2 (1%); MI 2 (1%); MN 6 (2%); MO 4 (1%); NC 3 (1%); PA 2 (1%); TN 1 (0.3%); VA 3 (1%); WI 2 (1%)	130	43
No state given	2	1

<sup>a</sup> Number of respondents from this state and the approximate percentage of all respondents that this number represents.

on either paper or electronic questionnaires. The same was true for non-professionals except for Scenario 9 where 24% ( $s_x = 8.5$ ) of respondents using the electronic version considered plants native while this value was 47% ( $s_x = 5.3$ ) for those using the paper version.

### Comments from Individual Respondents

While the actual basis for definition of nativity could not be determined in most cases in the questionnaire, the 11% of respondents who uniformly reported “native” for Scenarios 1 to 11 would appear to utilize definition strategies that are based purely on taxonomic description (Palmer and others 1995). A representative comment illustrates this:

*I consider each to be native because they are the same species. They may have different genetic material, but if the plants are sideoats grama, I consider the species as native.*

Other comments suggested that other relatively sophisticated definition algorithms may be followed. As in most published definitions (for example, Table 1), these comments tended to suggest to us that it is unproductive to apply the word “native” without thorough consideration and definition of at least spatial, temporal, and biological parameters:

*A native plant is an ecotype that occurred in the landscape at which it is found. . . at the time of European settlement on the soils where it now occurs and at the frequency which it now occurs.*

*Without any kind of genetic information on variation within and among populations, it's hard to know if off-site seed should be considered non-native.*

*“Native” versus “non-native” (without qualification) is too sharp a division—it depends on the unit under discussion. A species can be native to a region but its populations non-native on a particular site.*

*I tend to be liberal in my interpretation of native, believing “native” should be interpreted more in a continental perspective, considering the multitude of means by which seed migration is known to take place.*

It was also apparent that in some cases quite unconventional definitions of nativity may be in use. This further complicates attempts to develop more consistent interpretations of native status.

*In our city . . . we define a native plant as any species that matches our list of protected plants, regardless if the plant was cultivated or planted in an area and not grown as an act of nature.*

TABLE 4

*Affiliation or source of contact with questionnaire and percentage of respondents classified as professionals in plant-related fields*

Organization/ source of contact	Number of respondents	Percentage of all respondents	Percentage of respondents classified as “professional”
Native Plant Society	198	65	49
Society for Range Management	26	9	96
Native Plant Conservation Initiative (Plant Conservation Alliance)	9	3	89
Natural Areas Association	10	3	83
Society for Ecological Restoration	8	3	100
Society for Conservation Biology	2	1	100
Other/none	50	16	76
Total	303	100	—

TABLE 5

*Summary of native status designations for all respondents and scenarios*

Scenario	Factor(s) considered	Native status designation of seeds sown at revegetation site		
		Native	Not native	Not sure
		% of respondents		
1	None	95	1	4
2	Grazing	87	3	10
3	Different soil	76	7	17
4	Previous revegetation	27	27	46
5	Different native vegetation	81	7	12
6	Distance (1.6 to 16 km)	90.8	2.6	6.6
7	Distance (1.6 to 16 km) and elevation	76	5	19
8	Distance (16 to 160 km)	62.7	10.6	26.7
9	Distance (>160 km)	40	30	30
10	Weediness	59	16	25
11	Plant breeding (a cultivar)	17	50	34
12	From Mexico	43 <sup>a</sup>	33 <sup>a</sup>	24 <sup>a</sup>
13	From Mexico 84 y ago	35 <sup>a</sup>	38 <sup>a</sup>	27 <sup>a</sup>

<sup>a</sup> Includes only respondents from states that border Mexico (n=117)

TABLE 6

Summary of native status designations for all respondents grouped by association with a Native Plant Society (NPS) or professional status. Includes those scenarios where significant differences in response existed between groups

Native status designation of seed sown at revegetation site

Scenario	Factor considered	Groups	Native status designation of seed sown at revegetation site		
			Native —% of respondents—	Not native	Not sure
3	Different soil	Non-NPS	85	7	8
		NPS	70.6	7.6	21.8
11	Plant breeding (a cultivar)	Non-NPS	27	43	30
		NPS	11	53	36
1	None	Professional	99	1 <sup>a</sup>	
		Non-professional	89	11 <sup>a</sup>	
2	Grazing	Professional	93	7 <sup>a</sup>	
		Non-professional	79	21 <sup>a</sup>	
11	Plant breeding (a cultivar)	Professional	21	46	33
		Non-professional	11	55	34

<sup>a</sup> Number of respondents for “not native” and “not sure” combined because value for one or both was < 5.

DISCUSSION AND CONCLUSIONS

Not surprisingly, data from our questionnaire along with comments from respondents show that significant disagreement may exist among individuals in how they define nativity in revegetation scenarios. Where significant differences in definition existed, professionals in plant-related fields tended to be more liberal in their designation of native status than were non-professionals. This may reflect professionals’ more thorough understanding of complexities involved in determining native status (Webb 1985; Schwartz 1997). Moreover, our research showed that disagreement may be common even among groups of professionals.

The questionnaire also demonstrated the widespread reluctance to consider cultivars to be native within revegetation projects, especially by non-professionals (Tables 6 and 7). This reflects the commonly expressed view (for example, Lesica and Allendorf [1999]) that plant materials derived from conscious plant breeding have undergone modifications that radically diminish their compatibility with views of what “natural” plant communities might represent.

Two respondent comments seemed to summarize what we see as core messages of this questionnaire:

*The question seems to be “When should a different ecotype of a species than the local ecotype be con-*

*sidered non-native?” – assuming that different ecotypes of the species can be identified. It is not a biological issue so much as one of peoples’ perception of the meaning of “native.”*

*Nativity is a continuum and we humans want to categorize. So there is inherent conflict. The truth is that there are shades of nativity. But practically we do have to draw lines sometimes.*

Given the level of disagreement that exists regarding the definition of nativity, we believe that all situations where this issue is involved should be considered with 3 basic tenets in mind:

1. Everyone concerned with natural environments should become better informed of appropriate criteria for assigning native status and take all opportunities to discuss these with others. While consensus seems unlikely, a more open discussion may lead to less confusion.

2. Nonchalant or ambiguous usage of the word “native” or its common synonyms such as “indigenous” should be identified and eliminated. Without clear explanation of presumed meaning(s), it is obvious that misunderstandings will continue to be common.

3. Efforts should be supported to develop a better understanding of the basis for, and measurement of, ecological significance of local adaptation (Brown and Brown 1996; Lesica and Allendorf 1999). Given this, it will be possible to more accurately determine the most biologically appropriate sampling strategies to use when collecting local propagules for use in revegetation.

Future debate over determination of native status may become more contentious as the advancement of human-induced change escalates (Schwartz 1997). Development of realistic ecological goals and acceptable management objectives in revegetation activities must be based on scientifically defined criteria and an understanding of ecological and evolutionary principles (Houston and Schreiner 1994; Moritz 1999). Professionals would seem to be in a position to play a more active role in facilitating discussion of the scientific principles underlying definitions of nativity. Ultimately though, we believe that the success of revegetation projects involving native plants will also depend on understanding (Colton and Alpert 1998) and acceptance of the vision and the compromise of all stake-holders.

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## AUTHOR INFORMATION

Steven E Smith  
School of Renewable  
Natural Resources  
301 Biological Sciences East  
University of Arizona  
PO Box 210043  
Tucson, AZ 85721-0043  
azalfalf@ag.arizona.edu

Susan R Winslow  
USDA Natural Resources  
Conservation Service  
Plant Materials Center  
Bridger, MT 59014  
swinslow@mt.nrcs.usda.gov

TABLE 7

*Summary of native status designations for respondents classified as professionals in plant-related fields grouped by association with a Native Plant Society or the Society for Range Management. Includes those scenarios where significant differences in response existed between groups*

Scenario	Factor considered	Groups	Native status designation of seed sown at revegetation site		
			Native	Not native % of respondents	Not sure
11	Plant breeding (a cultivar)	Non-NPS (n = 92)	30	39	31
		NPS (n = 96)	12	52	36
4	Previous revegetation	Non-SRM <sup>a</sup> SRM	22 48		78 <sup>b</sup> 52 <sup>b</sup>
8	Distance (16 to 160 km)	Non-SRM SRM	58 84		42 <sup>b</sup> 16 <sup>b</sup>
9	Distance (>160 km)	Non-SRM SRM	36 64		64 <sup>b</sup> 36 <sup>b</sup>
10	Weediness	Non-SRM SRM	59 88		41 <sup>b</sup> 12 <sup>b</sup>
11	Plant breeding (a cultivar)	Non-SRM SRM (n = 25)	15 56		85 <sup>b</sup> 44 <sup>b</sup>
12	From Mexico	Non-SRM (n = 48) SRM (n = 14)	29 64		71 <sup>b</sup> 36 <sup>b</sup>

<sup>a</sup> Unless indicated, n = 163 for non-SRM and n = 25 for SRM.

<sup>b</sup> Number of respondents for "not native" and "not sure" combined because value for one or both was < 5.