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THE CENTER FOR
FOOD SAFETY

Oct. 25, 2004

Docket No. 03-101-2
Regulatory Analysis and Development
PPD, APHIS, Station 3C71
4700 River Rd., Unit 118
Riverdale, MD 20737-1238
Email: regulations@aphis.usda.gov

HAND-DELIVERED IN QUADRUPLICATE AND EMAILED

Re: scoping of EIS on petition from Monsanto Co. and The Scotts Co. seeking nonregulated status for glyphosate-tolerant creeping bentgrass (*Agrostis stolonifera* L.)

Dear Sir/Madam:

Thank you for the opportunity to comment on the above-referenced docket. The International Center for Technology Assessment (CTA) and the Center for Food Safety (CFS) are non-profit, public interest, advocacy organizations. We refer you to, and incorporate into this comment, all of the earlier evidence and arguments that CTA and CFS submitted on the GE variety at issue, glyphosate resistant creeping bentgrass, in their Petition on Genetically Engineered Turfgrasses, including a Noxious Weed Listing Petition (the Petition), filed with APHIS on July 18, 2002, and the supplemental evidence filed in support of the Petition, dated Apr. 21, 2003, as well in the comment CTA and CFS submitted to you dated Mar. 4, 2004, in response to your earlier request for comments on this same deregulation proposal, under your Docket No. 03-101-1. This latter CTA/CFS comment, in particular, points out the numerous defects in the analysis within the Scotts/Monsanto deregulation application. Rather than repeat those defects in the EIS, APHIS must correct them in order to produce a reliable NEPA document.

The remainder of this comment is also endorsed by the following non-profit, public interest organizations: Friends of the Earth and Klamath Siskiyou Wildlands Center of Oregon.

Initially, APHIS deserves praise for its Sept. 2 Notice of Intent to prepare the first ever EIS on a deregulation petition for any genetically engineered (GE) crop. This is an important step that brings the agency's NEPA compliance for deregulation proposals more in line with comments and critiques made in the past not just by environmental and consumer groups, but also by the National Academy of Sciences.[1]

The importance of this EIS was dramatically increased by the recent EPA-sponsored monitoring report of the 400 acre field test near Madras, Oregon.[2] This peer-reviewed report's findings indicate that the bulk of the earlier public comments submitted to you that were positive as far as the Scotts/Monsanto deregulation petition should be discounted to the extent they were based on incorrect assumptions of much shorter pollen/gene flow ranges. On the other hand, the Watrud et al. report directly supports the concerns regarding foreseeable contamination expressed in the earlier public comments submitted to you by the United States Forest Service (USFS), Bureau of Land Management (BLM), The Nature Conservancy (TNC), California Department of Fish and Game, as well as by CTA/CFS, organic farmers, other turfgrass seed producers, scientists, private land owners, and many others. A strong, nationwide, interest exists in protecting parks, forests, grasslands, and other natural areas, as well as the other interests at stake, from the contamination and management problems that will be caused by the spread of glyphosate tolerant creeping bentgrass.

We have the following comments aimed at ensuring a high quality scope and level of analysis in the draft EIS.

1. <u>Geographic Scope Generally</u>. We note initially that granting deregulated status would allow the commercial release of the product across the nation. The resulting weed invasions and gene flow of the glyphosate tolerance trait and related impacts could manifest themselves in every conceivable region where there is a market for creeping bentgrass seed, plugs or turf rolls in the country, in short, virtually everywhere people reside, except perhaps the most arid desert zones. The scope of the EIS must be very broad geographically to analyze the foreseeably widespread impacts.

2. <u>Broad Affected Environment</u>. As you further scope the Affected Environments and Impacts sections we urge you to recognize the cascading and potentially irreversible effects of fertile GE glyphosate tolerant grass pollen blowing 14 miles or more from where it is first planted. It could easily spread across the entire nation as there is a golf course in virtually every county.

The Affected Environments section of the report must consider The Nature Conservancy's detailed documentation of the occurrence of creeping bentgrass as an invader in at least 18 distinct North American habitat types, i.e., boreal forest, riparian sedge, open canopy woodlands, shrublands, shrub-steppe, rare calcerous fens, rare native grasslands and prairies, moist meadows, swamps, coastal marshes, dunes, shorelines, swales, ditches, pastures, urban streets and vacant lots. Each of these habitat types must be described in the Affected Environments section, and correspondingly, the Impacts section should describe how each of these 14 natural habitat types and 4 human-built habitat types will be affected by nationwide planting of the proposed product.

On the scope and scale of potential impacts, we note that the comments submitted by the USFS, BLM, and TNC indicated that they had concerns that a substantial portion of the lands they manage could be affected by unwanted escape of this product. As indicated in Table 1, below, cumulatively these three entities manage a vast portion, about 20.0%, of the land surface of this country. In contrast, the total golf course land area is about one-sixth of 1% of the national land surface. While this is just a rough approximation, the EIS needs to get across to the reader this sort of sense of the scale of the potential impacts on land managers who are responsible for 120 times the land area than the area of the golf course where the purported benefits would occur. TNC alone manages 5 times the land area compared to the total covered by golf courses nationally. (Still the golf course area is big enough and dispersed enough to provide "inoculation" sites nationwide, from which pollen, seeds, and vegetative parts could spread.)

Table 1.

Land Type	Area	
	Acres	Sq miles
USFS Forests and Grasslands	191 million	298 thousand
BLM Lands	261 million	408 thousand
TNC Preserves	15 million	23 thousand
Cumulative	467 million	729 thousand
Area of the United States	2,264 million	3,537 thousand
% of total U.S. area managed by these three entities	20.6%	20.6%

	Area	
	Acres	Sq miles
Total Golf Course Area	>3 million	>4.7 thousand
Area of the United States	2,264 million	3,537 thousand
% of total U.S. area covered by golf courses	0.13%	0.13%

Sources: USFS website, "About Us," www.fs.fed.us/aboutus/ ; BLM homepage, www.blm.gov/nhp/index.htm ; TNC website, "Private Lands Conservation" nature.org/aboutus/howwework/conservationmethods/privatelands ; CIA website, "The World Factbook- United States" www.cia.gov/cia/publications/factbook/geos/us.html ; US Golf Assoc. Turfgrass and Environmental Research Online (2004) "A Multiple Index Environmental Quality Evaluation and Management System: Application to a Golf Course" usgatero.msu.edu/v03/n07.pdf

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3. Approve With Conditions Alternative. In your description and analysis of the Approve with Conditions Alternative, you should recognize that the applicants' stated intent (or "stewardship plan") to sell the deregulated product only to the golf market is not enforceable. It is foreseeable that

the product will be sold by retailers for a variety of uses, including unapproved uses for home lawns and landscaping. Past experience with GE StarLink corn, in which stewardship plans were ignored and bags of seed were in some instances mislabeled, fully justifies this concern. In addition, the low rates of farmer compliance with Bt corn resistance management "requirements" show clearly that company intent as far as marketing will not be reliably followed at the ultimate user stage. Indeed, because of the various claimed benefits for the GE bentgrass, it is foreseeable that the product eventually will be marketed for use in an estimated 40,000,000 residential lawns and parks, at least 40,000 athletic facilities, and countless other landscaping applications throughout the country. When a product is deregulated, advertised nationally, and becomes "hot," as Scotts/Monsanto unarguably will be pushing hard for, the developer's past assurances to one government agency about limited marketing become meaningless. Thus, BRS must assess the long term impacts broadly, not according to the developers' self-serving assertions.

The Approve with Conditions Alternative should describe what would be required to impose truly enforceable provisions limiting the use of the product to golf courses, imposing resistance management requirements to mitigate the development of Roundup resistant weeds, requiring monitoring, and so on. How would this be enforced? Will Federal and/or State personnel be available for monitoring and, if so, how many? Any enforcement conditions must include strict and widely announced penalties for marketing and containment violations, and include the duty to immediately engage in "cleanup" and habitat restoration if unauthorized planting or "escape" of the product is observed. Thus, the enforcement conditions described for this Alternative also should address how such requirements would be funded, presumably through a bond or mandatory insurance mechanism imposed on every retailer. As was demonstrated in the Starlink corn contamination fiasco, imposing responsibility for product stewardship only on the product developer is a recipe for failure.

We note that your Notice of Intent announcement mentions the potential use of straw and chaff from bentgrass for animal feed and the existing Food and Drug Administration approval for it (see FDA website www.cfsan.fda.gov/~rdb/bnfm079.html). Of course, this already approved use undercuts the repeated assurances from the proponents that the grass would be limited to golf courses. The Approve with Conditions Alternative should include the condition of prohibiting any use of the grass for animal feed because it plainly represents another pathway by which seeds and vegetative parts of the grass could easily be spread beyond any containment. The description of that Alternative should describe also how this non-feed use condition would be enforced nationwide.

Another approach to the Approve With Conditions Alternative is to specify as a condition that the proponent use male sterility or some other "built in" confinement condition in the creeping bentgrass product to prevent the foreseeable genetic contamination. Of course, the reliability of such an approach, and the impacts of failure or "leakage" of the approach, also must be assessed (see below).

4. Male Sterile Alternative. It is inconsistent with common EIS practice to analyze only three alternative actions, as your notice suggests. Three alternatives is typical of detailed EAs, not EISs, which almost invariably have at least four. Just assessing the options of: approve unconditionally, approve conditionally, or deny does not comport with the CEQ's NEPA guidance. The CEQ's authoritative 40 Most Asked NEPA Questions, provide:

> "1.a. Range of Alternatives. What is meant by "range of alternatives" as referred to in Sec. 1505.1(e)?
>
> A. The phrase "range of alternatives" refers to the alternatives discussed in environmental documents. It includes all reasonable alternatives, which must be rigorously explored and objectively evaluated,.....
>
> 2.A. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant."

The existence of a male sterile variety as a reasonable, potentially safer, approach cannot be ignored when considering the Scotts/Monsanto proposal and plainly you should consider it as a feasible alternative to the Proposed Action to deregulate a fertile, readily-hybridizing, GE variety. The fact that a sterile version is being field tested now (APHIS Permit No. 04-197-02r) indicates that assessment information is being gathered. In view of the Watrud et al. results indicating that approval of a fertile variety may not be practical or reasonable due to landscape-level contamination, no justification exists not to assess a Male Sterile Alternative that would likely pose less, although not zero, risk.[3] (This does not indicate that we would necessarily ultimately support a Male Sterile Alternative, rather that we support it being assessed.)

5. Complete Prohibition Alternative. Your proposed Denial Alternative (the required "No Action Alternative"), would deny the deregulation proposal but would not change the *status quo* of allowing field tests of this product nationwide, which are currently permitted in 33 States. As such, the EIS will need to analyze the potential for more massive contamination incidents from huge ongoing and future field tests. The Watrud et al. study confirms the imminent hazard to the environment posed by USDA's now indefensible practice of allowing unconfined field tests of the product pursuant to Categorical Exclusions under NEPA.

Indeed, USDA was warned of the hazard in an opinion the agency solicited from TNC; in a prophetic 2001 statement by Marilyn Jordan, Ph.D., a TNC Stewardship Ecologist (documented in the CFS/CTA Petition):

I also hope that all field tests of herbicide resistant turfgrasses will be stopped immediately. Because of the great distances which pollen can be carried it is highly likely that the gene for herbicide resistance will inevitably escape into the environment, if it hasn't already.

In addition to the Oregon site from which the recent contamination arose, an even larger field test is approved in Idaho (APHIS Permit No. 04-070-02r; 600 acres). This and other field tests present the same contamination risks and thus their impacts must be assessed under the No Action Alternative. Since some field tests are huge and are aimed at seed production, they may pose a greater risk than limited, carefully-conditioned, golf course use in which the grass is normally cut before pollen and seed are produced. This points to the need for another alternative: one that could be called a Complete Prohibition on Glyphosate Tolerant Creeping Bentgrass Alternative. (This Alternative would be consistent with APHIS approval of the CTA/CFS Noxious Weed Listing Petition for this variety.) Only then will the EIS be able to assess a future scenario involving no risk of contamination from this product. It is long past time APHIS BRS assessed this option in detail.

6. Impacts Analysis. Your Impacts analysis should not focus just on potential "invasiveness" of the product, which is too narrow of a conception. What APHIS is supposed to regulate under its "plant pest" and "weed" authority under the Plant Protection Act is not invasiveness, but rather a broader range of risks. Invasiveness is one of several characteristics that can cause a novel plant variety to be a weed. All potentially harmful characteristics must be assessed, particularly the long-term capacity to cause ecological and economic mischief. The definition of noxious weed at 7 USC § 7702(10) is:

any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment

Thus, your Impacts analysis must address the extent to which this GE creeping bentgrass product, after it has foreseeably invaded and hyrbridized all over the nation, "directly or indirectly injure[s] or cause[s] damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment". This broad scope of analysis is consistent with USDA's weed prevention mission. This would include, for example, analysis of the extent and impacts of a foreseeable massive increase in national glyphosate use.

Further, the EIS should include analysis of the fitness and adaptability of hybrids between glyphosate tolerant creeping bentgrass and wild or naturalized relatives, as well as introgressant wild plants (wild bentgrass relatives containing the glyphosate tolerance gene and relatively few other genes from the original glyphosate tolerant creeping bentgrass). These can vary considerably in different environments (see fitness discussion below). Therefore, it is important to determine the fitness of hybrid and introgressant plants and likely resulting impacts in the foreseeable habitats in which they may occur due to gene flow.

7. Contamination Scenarios. On top of analyzing long distance pollen flow from plantings of this grass, you should analyze the other pathways by which unwanted contamination would occur, i.e., via seeds being spread and vegetative spread. Creeping bentgrass contains approximately 8 million seeds per pound. Reportedly, a large containment violation incident already had occurred involving blown seed at the Oregon field test site, contaminating neighboring land and leading to a damages claim. The EIS should discuss this reported contamination incident because it represents an important pathway of foreseeable environmental harm associated with large seed production sites. The EIS must include analysis of the likelihood of more failures of APHIS's field test "confinement" conditions and other reasonable "unintended effects" scenarios; it must not sweep them under the rug.

8. Effects Related to Fitness. The fitness, or competitive properties, of a gene are of fundamental importance in determining whether that gene will persist and spread in the wild. Hybrids can differ dramatically in fitness, and different genes are expected to have different fitness effects, which may also differ depending on the species that the gene is found in and the environment where the plant-gene combination occurs. There is already evidence that many non-transgenic hybrids of creeping bentgrass and wild or naturalized relatives are as at least as fit as the parent plants, and are also fertile.[4]

It is often assumed that herbicide resistance genes will not confer a selective advantage in the absence of herbicide application. However, data indicate that the glyphosate tolerance gene may be fitness-neutral in creeping bentgrass. If that is also the case in wild relatives, the escaped gene will likely persist in wild hybrids and introgressants.

Population genetics suggests that if the gene is neutral, that it will remain at frequencies determined in significant part by gene flow. However, where such contaminated wild relatives occur in mixed populations caused by gene flow, use of glyphosate will strongly select for those plants containing the glyphosate tolerance gene, thereby greatly increasing their frequency. Such increased frequencies could thereafter be maintained in those populations. This scenario is especially feasible in large natural area environments where invading bentgrasses may be sprayed with glyphosate, and not observed again for a considerable time. In addition, if the glyphosate tolerant wild relatives occur in initially low frequencies, their escape from glyphosate treatment, while the majority non-tolerant grasses are killed, could easily be overlooked. Similar results could occur with homeowners or golf course managers, who may initially tolerate relatively small numbers of escapes from glyphosate treatment, unwittingly increasing the frequency of glyphosate tolerant wild relatives or hybrids.

For all of these reasons, it is critical in assessing the long term impacts of the Proposed Action for the fitness of the glyphosate tolerance gene to be assessed, both in wild hybrids and introgressants. Such assessments would need to be based on experiments conducted under truly contained conditions, such as greenhouses that prevent pollen escape, and using male sterile plants in small field plots if the greenhouse studies suggest fitness is not increased.[5]

If fitness is increased in initial experiments then we would strongly recommend that further field tests, and of course commercialization, not be allowed. We note that the EIS process is appropriate for requiring the applicant to conduct these experiments to provide the needed data.

9. Comparative and Cumulative Analysis. The EIS should provide comparative risk analysis to give the reader context. The risks of escape of unwanted genes grown in creeping bentgrass plantations should be compared to unwanted gene escape from other crops such as corn, soybeans, cotton, etc. This will give a sense of the scope and scale of the issues presented by the Proposed Action. Further, a Cumulative Effects analysis must take into account the widespread adoption of existing glyphosate tolerant crops. This has already led to the human-driven selection and emergence of serious new glyphosate tolerant weeds. The widespread potential use of the bentgrass product and the associated increased spraying of glyphosate in non-agricultural settings represents a massive upward selection pressure for glyphosate tolerant weeds. As the first EIS to address this issue, a thorough analysis of the cumulative effects of this trend nationally will be crucial.

Further the Cumulative Effects analysis should assess the foreseeable future presence of creeping bentgrass containing additional traits other than glyphosate tolerance. For example, field tests have been permitted in New Jersey for disease resistant and drought tolerant creeping bentgrass, where glyphosate tolerant bentgrass field tests also been extensively conducted. These field tests in fertile varieties now need to be considered in light of the Watrud et al. results. In particular, traits that have a possibility of conferring a fitness advantage to wild relatives, such as disease resistance or stress tolerance, need to be carefully evaluated. Even from small field tests, escape is possible, especially with a crop like bentgrass that is highly outcrossing with easily dispersed pollen and seeds, and that is perennial and can propagate vegetatively. As noted by the National Academy of Sciences, genes that confers a fitness advantage to a wild relative are generally expected to not only persist, but increase in frequency, even if introduced only once.[6] Stochastic considerations suggest that escape from smaller field tests will occur less frequently than from larger tests or from a deregulated product, but such escape must be taken seriously. The potential for multiple transgenes for other traits besides glyphosate tolerance ending up in wild bentgrasses, as has occurred with canola in Canada, also must be assessed.

10. Real World "Alternative" Herbicide Analysis. Your Impacts analysis must discount the often-repeated refrain from supporters of this particular grass that alternative herbicides are available. This argument is practically absurd because no one is going to know in advance whether a particular weedy

patch of *Agrostis* turfgrass needs the alternative treatment or not. As farmers, natural area managers, landscapers, and homeowners try to use the very popular and common herbicide glyphosate on the GE glyphosate tolerant variety, it will not be effective, but they will not know that at the time they spray. Thus, the GE glyphosate resistant variety will stay where it is not wanted, allowing it to continue to spread and be more invasive by any common-sense definition. Until such unpredictable time as the weed manager somehow learns that he or she has a glyphosate tolerant patch, the infestation will go entirely unchecked. It is not as if Scotts and Monsanto will be issuing regular alerts comprehensively advising weed managers nationally when and where the Roundup Ready trait has escaped via pollen, seeds, and vegetative spread.

Further, for several habitat types, such as sensitive wetland areas, there appear to be no suitable or approved alternative herbicide available at all. The EIS must thoroughly assess this risk based on facts, not on wishful thinking by the product's supporters. The foreseeability of these impacts highlights the need for the EIS Impacts analysis to focus on long-term impacts, that is, those that could be "irreversible and irretrievable," as called for by NEPA, rather than focusing on claimed short-term benefits for certain golf course operators.

For those situations in which the applicator does become aware of the need to apply an alternative to glyphosate, the Impacts analysis must fully assess the potential effects of those alternative herbicides in real-world settings. The EIS must assess such matters as foreseeable (based on past experience) rates of applicator misuse and resulting health and environmental damages.[7] Increased out-of-pocket expenses to weed managers due to the need for a second herbicide application is an additional impact.

11. Impacts on Organic. Your Impacts section also should address the economic harm to organic farmers near any GE grass plantings because of the increased presence of adventitious GE materials in their crops and the potential for increased glyphosate contamination, both of which are rejected by premium markets for organic products. Although this is an economic impact, it is a result of foreseeable GE pollen and seed contamination and must be assessed under standard NEPA practice.[8]

Many farmers and food processors already have been economically damaged by the contamination of non-GE crops by GE varieties. Further, organic farm land is "prime and unique agricultural land" which pursuant to CEQ guidance would require separate, focused impact analysis sections.[9]

12. Endangered Species Act. The EIS preparation should be accompanied by a formal Section 7 consultation under the Endangered Species Act, including preparation of a detailed Biological Opinion by the U.S. Fish and Wildlife Service. The results of that opinion should form the basis for threatened and endangered species section of the Impacts section that discusses effects on wildlife and native plants.

13. <u>Executive Order 1311</u>2 As was stated in detail in the CTA/CFS Petition (Requested Action 5, pp. 20-21), we urge you as part of the EIS process to comply with Sec. 2 of Executive Order 13112 on Invasive Species by adopting and following appropriate guidelines addressing the benefits and harms, and ways to minimize the harms, for all APHIS actions that "authorize, fund, or carry out actions" that may result in introduction of a new invasive variety, or that "may affect the status" of existing invasive weeds.

Both outcomes appear to be inherent in your Proposed Action. The relationship of the various Alternative Actions to the mandate in the EO should be analyzed in the EIS's Impacts section.

The EIS process should be open and transparent with numerous public meetings nationwide, reflective of the broad scope of the proposal. Given the potentially significant impacts discussed above and in the previous submissions by CTA/CFS and many others, we are confident that the EIS, if properly scoped and prepared, will reveal that for APHIS to eventually actually grant the Scotts/Monsanto deregulation petition would be inconsistent with your mission under the Plant Protection Act.

We look forward to your written responses to each of these comments separately and to reviewing the draft EIS. For further information regarding these comments, please contact Peter T. Jenkins, Attorney/Policy Analyst, tel: 202.547.9359; email: peterjenkins@icta.org.

Sincerely,

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Endnotes

[1] The National Academy, following a thorough review, concluded: "APHIS assessments of petitions for deregulation are largely based on environmental effects considered at small spatial scales. Potential effects from scale-up associated with commercialization are rarely considered." National Research Council/National Academy of Sciences. 2002. *Environmental Effects of Transgenic Plants: The Scope and Adequacy of Regulation.* Washington, DC., at p. 189.
[2] Watrud LS, et al. (2004) Evidence for landscape-level, pollen-mediated gene flow from genetically modified creeping bentgrass with *CP4 EPSPS* as a marker. Proceedings of the National Academies of Science, online at: www.pnas.org/cgi/10.1073/pnas.0405154101 .
[3] A Male Sterile Alternative must consider the failure rates that are inherent in male sterile breeding systems. These failure rates vary between different plant species and male sterility genes, and therefore need to be determined for the particular male sterile traits that foreseeably would be used with creeping bentgrass. Environment can also affect the efficiency of male sterility systems and must also be considered. The gene flow consequences of sterility failure rates should then be evaluated in standard population genetics models, such as the recent model described in, Haygood R, Ives A, and Andow D (2004) Population genetics of transgene containment. Ecology Letters vol. 7 doi: 10.1111/j.1461-0248.2004.00575.x. Furthermore, perennial male sterile creeping bentgrass may still escape via vegetative propagation or dispersal of the very small seeds by wind, spillage or other means. The male sterile glyphosate tolerant creeping bentgrass would remain female fertile, so seed production could still occur, especially between escaped and wild plants. It is also important to determine the frequency of male fertility restoring genes found in wild and naturalized relatives. Finally, even if escape is drastically slowed compared to a fertile product, the rate of spread and ultimate frequency of the glyphosate tolerance gene in wild populations will depend on fitness considerations (see fitness discussion in this comment).
[4] Wipff JK, and Fricker C (2001) Gene flow from transgenic creeping bentgrass (*Agrostis stolonifera* L.) in the Willamette Valley, Oregon. International Turfgrass Soc. Research Journal 9: 224-242; Belanger FC. et al. (2003) Interspecific hybridization as a potential method for improvement of *Agrostis* species. Crop Science 43:2172-2176.
[5] See for example Snow AA, et al. (2003) A Bt transgene reduces herbivory and enhances fecundity in wild sunflowers. Ecological Applications 13(2):279-286.
[6] National Research Council, "Biological Confinement of Genetically Engineered Organisms," 2004, National Academies Press, Washington, D.C., see Chapter 2.
[7] See CTA/CFS comments on potential health impacts of glyphosate misuse in their earlier submissions.
[8] See the definition of "effects" in the CEQ NEPA regulations, 40 CFR 1508.8:
"'Effects'" include:

(a) Direct effects, which are caused by the action and occur at the same time and place.

(b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Effects and impacts as used in these regulations are synonymous. Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial."

[9] See CEQ NEPA Guidance document dated Aug. 11, 1980, Memorandum for Heads of Agencies on Prime and Unique Agricultural Lands, signed by Gus Speth, CEQ Chairman, online at ceq.eh.doe.gov/nepa/regs/exec81180.html .