- **1991 – USGS begins National Water Quality Assessment Program**
- **1999 – USGS publishes “The Quality of Our Nation’s Waters” with specific reference to nutrients and pesticides**

Conclusion

- Differences in natural features and land management practices make some areas more vulnerable to contamination than other areas.

Significance

- Recognition of differences in vulnerability to contamination can help target resources for protection of groundwater at greatest risk. The most extensive control strategies should be on the more vulnerable settings.

Groundwater vulnerability separated into intrinsic and specific vulnerability.

- Intrinsic are factors over which farmer has no control, such as soil hydrological properties and hydrogeological factors. Each type of irrigation system and crop has an intrinsic vulnerability.
- Specific vulnerability is a function of management factors such as quantity, rate, timing, and methods of nitrogen and water application.

'ARISTOTLE.'

"It is the mark of an instructed mind to rest satisfied with the degree of precision which the nature of the subject permits, and not to seek an exactness where only an approximation of the truth is possible."

Aristotle

PURPOSE

To provide information for farmers to voluntarily target resources for management practices that will yield the greatest level of reduced nitrogen contamination potential for ground water by identifying the fields of highest intrinsic vulnerability.

This is not a new concept in California. I served on two committees that proposed using a hazard index based on the soil, crop, and irrigation systems. The most recent was the Nutrient Technical Advisory Committee (TAC) appointed by the State Water Resources Control Board (1994). The recommendations of TAC have never been implemented because a hazard rating for each crop and soil had to be established. We generally followed the guidelines proposed by TAC but did make some modification in detail.

What is Important in Protecting Groundwater

- Less NO_3 concentration or less total mass of NO_3 percolating beyond the root zone?
- Obvious answer is to have both.
- However, low concentration may not necessarily equate to low mass flow.

Consider Conservative Salt

$$C_d = C_i / LF$$

C_d is concentration of water leaving the root zone

C_i is concentration in irrigation water

LF is leaching fraction

$$LF = (AW-ET) / AW = DP / AW$$

AW is applied water that infiltrates the soil

DP is amount of deep percolation

$$C_d = C_i AW / DP$$

Increasing DP causes decreasing concentration

Relationship Between Fertilizer Application and Irrigation on N Concentration Below Root Zone

N Application kg/ha	Irrigation cm	N Conc. mg N/L	Calc. N Leached kg/ha
0	100	8.6	13.2
90	100	12.4	20.2
179	100	16.9	26.8
358	100	32.1	66.7
0	60	9.4	0.52
90	60	12.1	0.78
179	60	15.4	1.03
358	60	35.9	2.95
0	20	16.2	0.0
90	20	27.2	0.0
179	20	34.0	0.0
358	20	47.0	0.0

Extensive Investigation on NO_3 in Ag. Tile Drain in 1970s

- No correlation between NO_3 concentration and fertilizer application
- Correlation between mass of NO_3 and fertilizer application
- No correlation between NO_3 concentration and amount of drainage water
- Correlation between mass of NO_3 and amount of drainage water

Results of USGS measured NO_3 concentrations in domestic wells:

- NO_3 concentration not correlated with N-fertilizer application within a 0.25- and a 0.50-mile radius.
- No relationship between NO_3 concentration and soil permeability, hardpan percent, and clay percent.
- The lack of a relationship to soil properties in the counter balancing effect of reduced leaching fraction and increased denitrification. No measurement of mass flow.

Whether, from a groundwater quality perspective, it is better to have a high volume of leachate water with a low concentration of NO_3 or to have a smaller volume of leachate with a higher concentration can be debated.

A conclusion that is well supported by research findings and scientific principles is that the concentration is not a valid indicator of good versus bad agricultural management.

Nutrient TAC Report

- *http://www.swrcb.ca.gov/nps/docs/tac_nutrient.doc*
- **Recommended Hazard Index for:**
  - **Soils**
  - **Crops**
  - **Irrigation System**

- Nitrate is carried downward by water flowing through the soil
- Water and nitrate that passes below the root zone will not be retrieved
- Therefore, crops with shallow root systems are more suseptable
- Clay layers in the soil retard water flow, can become saturated and cause nitrate to be denitrified.

- **Irrigation uniformity is important**
- **With nonuniform irrigation it is impossible to get maximum yield without deep percolation**
- **Also impossible to have low deep percolation without yield reduction**
- **Furrow irrigation is nonuniform because soil nonuniformity and time water is on different parts of the furrow.**

Soil Rating

The hazard rating for soils is 1 through 5.

- Soils rated as 1 are those that have textural or profile characteristics that inhibit the flow of water and create an environment conducive to denitrification.
- Soils rated as 5 are those that have high water infiltration rates, high water transmission rates through the profile, and low denitrification potential.
- Soils rated 2, 3, or 4 are those with intermediate properties.

Crop Rating

The hazard rating for crops is from 1 through 4. Factors considered in establishing the crop hazard rating include:

1. Rooting depth
2. Ratio of N in crop tops to recommended N application
3. Fraction of the crop top N that is removed from the field with the marketable product
4. Magnitude of the peak N uptake rate
5. Whether the crop is harvested at a time when the N uptake rate is high

A slightly different set of criteria was used for tree and vine crops.

Irrigation System Rating

We accepted the rating system proposed by TAC for irrigation systems

1. Micro-irrigation accompanied by fertigation
2. Micro-irrigation without fertigation
3. Sprinklers used for pre-irrigation or throughout the irrigation system
4. Surface irrigation systems throughout the season

Integrated Hazard Index (HI)

- Multiply the soil, crop, and irrigation system hazard ratings
- Result is a number from 1 through 80
- We propose a HI of 1 through 20 is of minor concern
- A HI greater than 20 should receive careful management attention
- Equally, if not more, important than the numerical value of the HI are the factors that lead to the higher HI values. These provide management guidelines for reducing NO_3 transport to groundwater

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http://www.lib.berkeley.edu/WRCA/WRC/wqp_hazard.html

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Water Quality Program - Nitrate Groundwater Pollution Hazard Index

Find Your Index Number

HI NO_3^- for Irrigated Agriculture in the Southwest

Purpose: To provide information for farmers to voluntarily target resources for management practices that will yield the greatest level of reduced nitrogen contamination potential for groundwater by identifying the fields of highest intrinsic vulnerability.

How it Works: The index works with an overlay of soil, crop, and irrigation information. Based on the three components, an overall potential hazard number is assigned and management practices are suggested where necessary. If you don't know what soil type you have, try this online soil survey with detailed soil survey data for much of California, Arizona, and Nevada.

More Information:

- Hazard Index Concept (background information & process) (pdf, 54kb)
- Supporting Evidence for the Nitrate Groundwater Pollution Hazard Index Concept (pdf, 49kb)
- Concentration versus Mass Flow (pdf, 61kb)
- Irrigation Principles (pdf, 49kb)
- Dynamics of Nitrogen Availability and Uptake (pdf, 124kb)
- Basic Factors Affecting N Transport through Soils (pdf, 107kb)
- Interpretation of Nitrate Groundwater Pollution Hazard Index Number (pdf, 42kb)
- Workshop Presentations:
  - Background Information and Supporting Evidence for the Hazard Index (pdf, 154kb)

Water Quality Program

- Water Issues Survey
- Watershed Management
- Nutrients & Pesticide Mgmt.
- Drinking Water & Human Health
- Water Cons. & Ag Water Mgmt.
- Water Policy & Econ.
- Animal Manure & Waste Mgmt.
- Nitrate Hazard Index

Done

Lettuce, Leaf

The hazard rating for the production of Lettuce, Leaf is high ('4') because

- nitrate is likely to quickly move beneath the shallow roots of this crop
- a moderate amount of the fertilizer-N you apply is concentrated within the crop's vegetation, reducing nitrate available in the soil to be leached
- a low proportion of the N concentrated within plant tissues is removed during harvest, leaving most atop the soil in the crop residue. Here it can be mineralized and become available for subsequent crops or leaching.

Lettuce, Leaf

- High value crops, such as lettuce, leaf, tend to be over-fertilized by growers. Often the same yields can be realized with less added N than common knowledge dictates. To help you keep abreast of current recommended practices for the addition of N, some information resources are listed at the end of this page.
- The amount of water applied during irrigation of crops with shallow roots must be carefully monitored. Otherwise soluble nitrate may be leached beneath the crops rooting zone prior to the time required for the crop to utilize the applied N for plant growth.
- A moderate amount of added fertilizer-N accumulates within lettuce, leaf during growth. This leaves N in the soil, available to be leached. Additionally, the N removed from the soil during the growth of lettuce, leaf, is almost all left on the soil surface after harvest in the form of plant residue. The nitrogen in this plant residue can be easily mineralized and then leached. This suggests the use of cover crops to immobilize N during fallow periods. Successfully immobilizing N has the benefit of 'free' nitrogen added to your soil, which should reduce your fertilizer costs. At the beginning of each growing season, your soil can be tested to see how much nitrogen is available in it for use by your crop. Extension specialists in your state can direct you in how to have these tests done.

Hazard rating for your soil type (Sorrento): 3.

- **Your soil type has a hazard rating of '3'.** Such soils have moderate rates of infiltration and water movement through the soil and moderate soil-water holding capacity. These soils allow less frequent irrigation with more water per irrigation than soils rated '4' or '5'. Nevertheless, excessive water application will leach nitrates to groundwater. Denitrification, in which soil bacteria convert nitrates to gaseous nitrogen, may decrease the risk that excess N will move to the underlying aquifer in some of these soils.
- **Effect of irrigation method.** Soils rated '3' generally have some physical characteristics which slow permeability. Generally, these soils can be managed to have low risk of polluting ground water. Irrigation water should be judiciously applied using well-maintained irrigation systems and in concert with a fertilizer-nitrogen application plan tailored to your crop. This can be accomplished most precisely by drip irrigation in combination with fertigation. Using this combination you can provide several carefully timed applications of N that closely match the growth requirements of developing plants. When using sprinklers, irrigate to add enough water per session to recharge the root zone. For surface irrigation, the use of reduced furrow lengths will shorten set times and depth of infiltration. Banding fertilizer between the furrow and the plant is very important when using furrow irrigation so that the infiltrating water can carry the fertilizer into the root zone rather than straight down towards underlying aquifers.
- For an official description of your soil type, Sorrento, **click here**.

Hazard rating for Micro-irrigation system w/fertigation: 1.

- Using drip irrigation in combination with fertigation carries a hazard rating of ‘1’. Precise additions of fertilizer-N dissolved within the irrigation water allow good control of soil moisture depth distributions and nutrient concentration. These can then be closely matched to the needs and geometry of the growing root mass. Excess soil water and nitrate are greatly limited, thus greatly limiting, in turn, the movement of agricultural pollutants to underlying aquifers.
- Effect of soil type: Drip irrigation is particularly effective on soils rated ‘3’, ‘4’, or ‘5’, but may be more difficult to manage in soils rated ‘1’ or ‘2’ because of their low hydraulic properties. Additionally, drip irrigation may be problematic on soils with high shrink-swell characteristics that create huge, deep cracks.
- Prior to setting up a micro-irrigation system with fertigation, it is especially important that you become knowledgeable concerning the timing of the amounts and depths of N required by your crop during its development. All techniques for applying water and fertilizer-N will contribute to groundwater contamination if their required amounts are exceeded.
- Micro-irrigation and micro-irrigation with fertigation have been shown to increase yields while reducing water and fertilizer costs. However, it is highly recommended that you consult with a knowledgeable contractor to help plan your hardware installation. Making a well-informed decision on equipment selection will help reduce costs due to clogged emitters and root intrusion, and during phased replacement of system components such as drip tape and tubing.

Strawberries

The hazard rating for the production of Strawberries is high ('4') because

- nitrate is likely to quickly move beneath the shallow roots of this crop
- a moderate proportion of the N concentrated within plant tissues is removed during harvest, leaving some atop the soil in crop residue and available for leaching

Strawberries

- High value crops, such as strawberries, tend to be over-fertilized by growers. Often the same yields can be realized with less added N than common knowledge dictates. To help you keep abreast of current recommended practices for the addition of N, some information resources are listed at the end of this page.
- The amount of water applied during irrigation of crops with shallow roots must be carefully monitored. Otherwise soluble nitrate may be leached beneath the crops rooting zone prior to the time required for the crop to utilize the applied N for plant growth. Since your soil allows the rapid movement of water carrying nitrate to depth, it is essential that you pay careful attention to your irrigation methods.
- Significant amounts of N are taken up during the growth of strawberries. This leaves little behind in the soil to be leached. Some of this N accumulates in the marketable portion of the plant structure, but some is also left behind on the surface of the soil after harvest. This N left behind in the plant tissues can be mineralized and then leached during the rainy season.

Hazard rating for your soil type (Elder): 4.

- **Your soil type has a hazard rating of '4'.** Irrigation water will percolate through it fairly rapidly, carrying nitrate towards underlying groundwater. With loamy textures relatively high in sand, these soils are generally permeable with ready infiltration and their water holding capacity is moderately low. Denitrification, which converts nitrates to gaseous nitrogen, is low in these soils, thus further increasing the risk that any excess N added to these soils will move relatively quickly to the underlying aquifer.
- **Effect of irrigation method.** While soils rated '4' generally have slightly slower permeability than soils rated '5', they still have few physical restrictions to water movement to depth and relatively low water holding capacity. Control of the amount and timing of added water is very important in order to focus soil moisture and fertilizer nutrients on the root zone of the growing crop. This can be accomplished most precisely by drip irrigation in combination with fertigation. Using this combination you can provide several carefully timed applications of N that closely match the growth requirements of developing plants. When using sprinklers, irrigate only with the amount of water needed to recharge the root zone in order to reduce the potential for groundwater contamination. For surface irrigation, the use of short furrow lengths and high water application, which rapidly moves the water across the field, will shorten set times and depth of infiltration. Banding fertilizer between the furrow and the plant is very important when using furrow irrigation so that the infiltrating water can carry the fertilizer into the root zone rather than straight down towards underlying aquifers.
- For an official description of your soil type, Elder, **click here**.

Hazard rating for Sprinklers: 3.

- Irrigating with sprinklers carries a hazard rating of "3“. Sprinkler systems can be managed to produce uniform irrigation when carefully selected, installed, calibrated, and maintained. However, to do so requires considerable vigilance. Additionally, changes in environmental variables, such as wind speed and crop canopy characteristics, can greatly alter the pattern of water drop distribution, often requiring alterations to the timing and duration of irrigation. Crop canopy capture varies over the course of crop growth with larger plants capturing more water. Smaller and more frequent irrigations help deliver a spatially focused pulse of water – and fertilizer -- to the root zone. One benefit of sprinkler is that the amount of water applied can be controlled manually or electronically.
- Effect of soil type: Sprinklers are appropriate for all soil types as long as the water application intensity is designed to be equal or less than the infiltration rate of the soil being irrigated.

Avocados

The hazard rating for the production of Avocados is moderate ('2') because

- nitrate movement to depth will be slowed as it is taken up by this crop's deep roots
- a high proportion of the fertilizer-N you apply is concentrated within the crop's vegetation, leaving less in the soil to be leached
- a low proportion of the N concentrated within plant tissues is removed during harvest, leaving most atop the soil in the crop residue. Here it can be mineralized and become available for subsequent crops or leaching

Avocados

- High value crops, such as avocados, tend to be over-fertilized by growers. Often the same yields can be realized with less added N than common knowledge dictates. To help you keep abreast of current recommended practices for the addition of N, some information resources are listed at the end of this page.
- Deep roots are generally viewed as being helpful in retarding the movement of nitrate to groundwater. The deeper the roots, the more time that nitrate has to be taken-up by crops during growth. For orchards or vineyards, it is important to greatly reduce fertilization at the end of the dry season -- normally the end of October -- since soluble nitrate can be carried quickly towards underlying aquifers along well-established root channels following the first large rains of the season.
- Significant amounts of N are taken up during the growth of avocados. This leaves little behind in the soil to be leached. However, while N is removed from the soil during the growth of avocados, it is redeposited on the soil surface after harvest in the form of plant residue. The nitrogen in this plant residue -- which is significant since there is a large amount of leaf drop over the course of the year -- can be easily mineralized if left atop the soil and then leached. This suggests the use of cover crops to immobilize N during the rainy season. Successfully immobilizing N has the benefit of 'free' nitrogen added to your soil, which should reduce your fertilizer costs. At the beginning of each growing season, your soil can be tested to see how much nitrogen is available in it for use by your crop. Extension specialists in your state can direct you in how to have these tests done.

Hazard rating for your soil type (Todos): 2.

- **Your soil type has a hazard rating of "2".** These soils slow the leaching of nitrate to underlying groundwater, generally due to the presence of clay and silt, or a shallow restrictive layer (hardpan, duripan, or bedrock). Denitrification, in which bacteria convert nitrates to gaseous nitrogen, probably decreases the risk that excess N will move to the underlying aquifer.
- **Effect of irrigation method.** Soils rated '2' generally have slow permeability due to their fine textures. Additions of irrigation water and fertilizer nitrogen tend to remain near the land surface and move to depth slowly. This allows some latitude in your choice of irrigation methods. Generally, any carefully managed and well-maintained irrigation system can be used on these soils with relatively low risk of polluting ground water as long as it is used in conjunction with a fertilizer-nitrogen application plan tailored to your crop. Denitrification can occur in these soils, which further reduces the risk of nitrates being transported to groundwater.
- For an official description of your soil type, Todos, **click here**.

Hazard rating for Surface Irrigation: 4.

- Surface irrigation methods carry a hazard rating of ‘4’. Water distributed as flow down furrows or ponded in basins provides non-uniform irrigation. Regions of the soil first covered by water – such as the head of furrows -- have extra time for infiltration, allowing deeper percolation and movement of nitrate, compared to the tail of furrows. To improve the uniformity of surface irrigation, the amount of time that water covers all regions of the soil surface should be equalized. Generally, decreasing the time required to apply surface irrigation, such as by shortening furrow length, smoothing furrow surfaces, or increasing application rates, helps.
- Effect of soil type: The potential for negative effects of surface irrigation on groundwater quality is high for soils with rapid percolation, such as those rated ‘5’ and ‘4’, and greatly reduced for those rated ‘1’, where percolation is very limited and natural ponding can occur.

Grapes, wine

The hazard rating for the production of Grapes, Wine is low ('1') because

- nitrate movement to depth will be slowed as it is taken up by this crop's deep roots
- a high proportion of the fertilizer-N you apply is concentrated within the crop's vegetation, leaving less in the soil to be leached
- a moderate proportion of the N concentrated within plant tissues is removed during harvest, leaving some atop the soil in crop residue and available for leaching

Grapes, wine

- High value crops, such as grapes, wine, tend to be over-fertilized by growers. Often the same yields can be realized with less added N than common knowledge dictates. To help you keep abreast of current recommended practices for the addition of N, some information resources are listed at the end of this page.
- Deep roots are generally viewed as being helpful in retarding the movement of nitrate to groundwater. The deeper the roots, the more time that nitrate has to be taken-up by crops during growth. For orchards or vineyards, it is important to greatly reduce fertilization at the end of the dry season -- normally the end of October -- since soluble nitrate can be carried quickly towards underlying aquifers along well-established root channels following the first large rains of the season.
- Significant amounts of N are taken up during the growth of grapes, wine. This leaves little behind in the soil to be leached. Some of this N accumulates in the marketable portion of the plant structure, but some is also left behind on the surface of the soil after harvest. This N left behind in the plant tissues can be mineralized and then leached during the rainy season -- even though there is only a moderate amount of leaf drop over the course of the year.

Hazard rating for your soil type (Botella): 3.

- **Your soil type has a hazard rating of '3'.** Such soils have moderate rates of infiltration and water movement through the soil and moderate soil-water holding capacity. These soils allow less frequent irrigation with more water per irrigation than soils rated '4' or '5'. Nevertheless, excessive water application will leach nitrates to groundwater. Denitrification, in which soil bacteria convert nitrates to gaseous nitrogen, may decrease the risk that excess N will move to the underlying aquifer in some of these soils.
- **Effect of irrigation method.** Soils rated '3' generally have some physical characteristics which slow permeability. Generally, these soils can be managed to have low risk of polluting ground water. Irrigation water should be judiciously applied using well-maintained irrigation systems and in concert with a fertilizer-nitrogen application plan tailored to your crop. This can be accomplished most precisely by drip irrigation in combination with fertigation. Using this combination you can provide several carefully timed applications of N that closely match the growth requirements of developing plants. When using sprinklers, irrigate to add enough water per session to recharge the root zone. For surface irrigation, the use of reduced furrow lengths will shorten set times and depth of infiltration. Banding fertilizer between the furrow and the plant is very important when using furrow irrigation so that the infiltrating water can carry the fertilizer into the root zone rather than straight down towards underlying aquifers.
- For an official description of your soil type, Botella, **click here**.

Lettuce, Leaf

The hazard rating for the production of Lettuce, Leaf is high ('4') because

- **nitrate is likely to quickly move beneath the shallow roots of this crop**
- **a moderate amount of the fertilizer-N you apply is concentrated within the crop's vegetation, reducing nitrate available in the soil to be leached**
- **a low proportion of the N concentrated within plant tissues is removed during harvest, leaving most atop the soil in the crop residue. Here it can be mineralized and become available for subsequent crops or leaching.**

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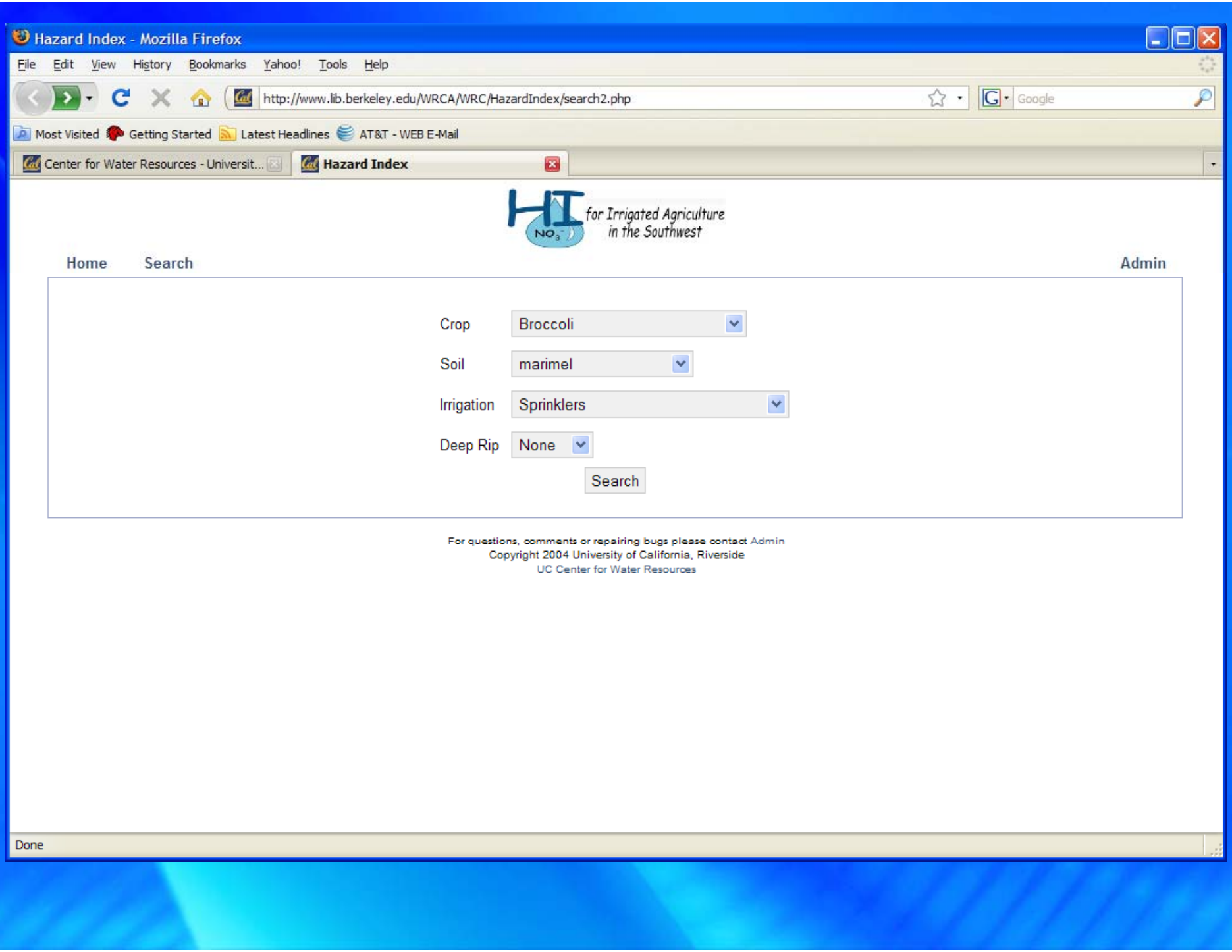
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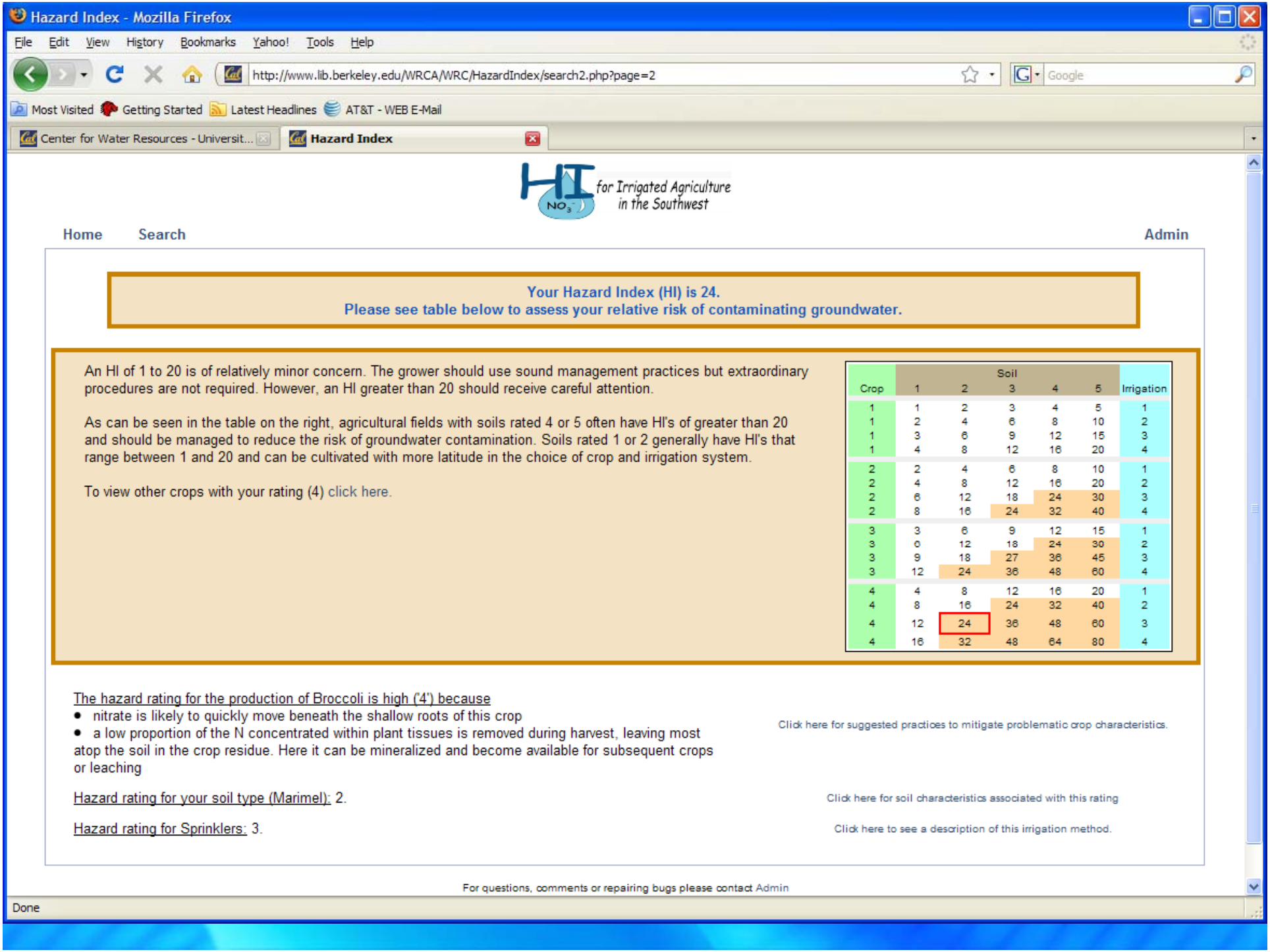
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Your Hazard Index (HI) is 24.
Please see table below to assess your relative risk of contaminating groundwater.
An HI of 1 to 20 is of relatively minor concern. The grower should use sound management practices but extraordinary procedures are not required. However, an HI greater than 20 should receive careful attention.
As can be seen in the table on the right, agricultural fields with soils rated 4 or 5 often have HI's of greater than 20 and should be managed to reduce the risk of groundwater contamination. Soils rated 1 or 2 generally have HI's that range between 1 and 20 and can be cultivated with more latitude in the choice of crop and irrigation system.
To view other crops with your rating (4) click here.
Crop | Soil 1 2 3 4 5 | Irrigation
1 1 2 3 4 5 1
1 2 4 6 8 10 2
1 3 6 9 12 15 3
1 4 8 12 16 20 4
2 2 4 6 8 10 1
2 4 8 12 16 20 2
2 6 12 18 24 30 3
2 8 16 24 32 40 4
3 3 6 9 12 15 1
3 6 12 18 24 30 2
3 9 18 27 36 45 3
3 12 24 36 48 60 4
4 4 8 12 16 20 1
4 8 16 24 32 40 2
4 12 24 36 48 60 3
4 16 32 48 64 80 4
The hazard rating for the production of Broccoli is high ('4') because
nitrate is likely to quickly move beneath the shallow roots of this crop
a low proportion of the N concentrated within plant tissues is removed during harvest, leaving most atop the soil in the crop residue. Here it can be mineralized and become available for subsequent crops or leaching
Click here for suggested practices to mitigate problematic crop characteristics.
Hazard rating for your soil type (Marimel): 2.
Click here for soil characteristics associated with this rating
Hazard rating for Sprinklers: 3.
Click here to see a description of this irrigation method.
For questions, comments or repairing bugs please contact Admin
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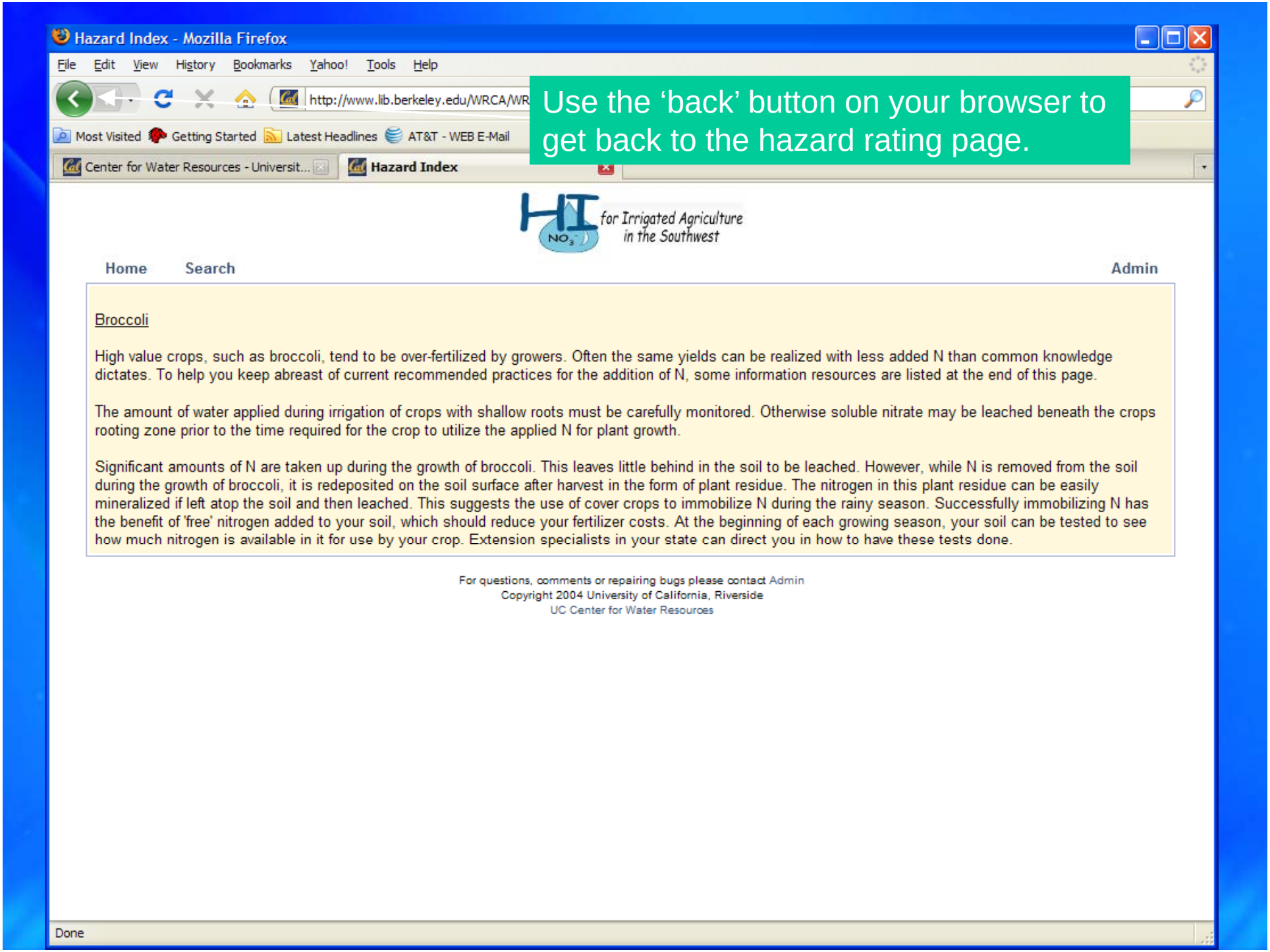
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Broccoli
High value crops, such as broccoli, tend to be over-fertilized by growers. Often the same yields can be realized with less added N than common knowledge dictates. To help you keep abreast of current recommended practices for the addition of N, some information resources are listed at the end of this page.
The amount of water applied during irrigation of crops with shallow roots must be carefully monitored. Otherwise soluble nitrate may be leached beneath the crops rooting zone prior to the time required for the crop to utilize the applied N for plant growth.
Significant amounts of N are taken up during the growth of broccoli. This leaves little behind in the soil to be leached. However, while N is removed from the soil during the growth of broccoli, it is redeposited on the soil surface after harvest in the form of plant residue. The nitrogen in this plant residue can be easily mineralized if left atop the soil and then leached. This suggests the use of cover crops to immobilize N during the rainy season. Successfully immobilizing N has the benefit of 'free' nitrogen added to your soil, which should reduce your fertilizer costs. At the beginning of each growing season, your soil can be tested to see how much nitrogen is available in it for use by your crop. Extension specialists in your state can direct you in how to have these tests done.
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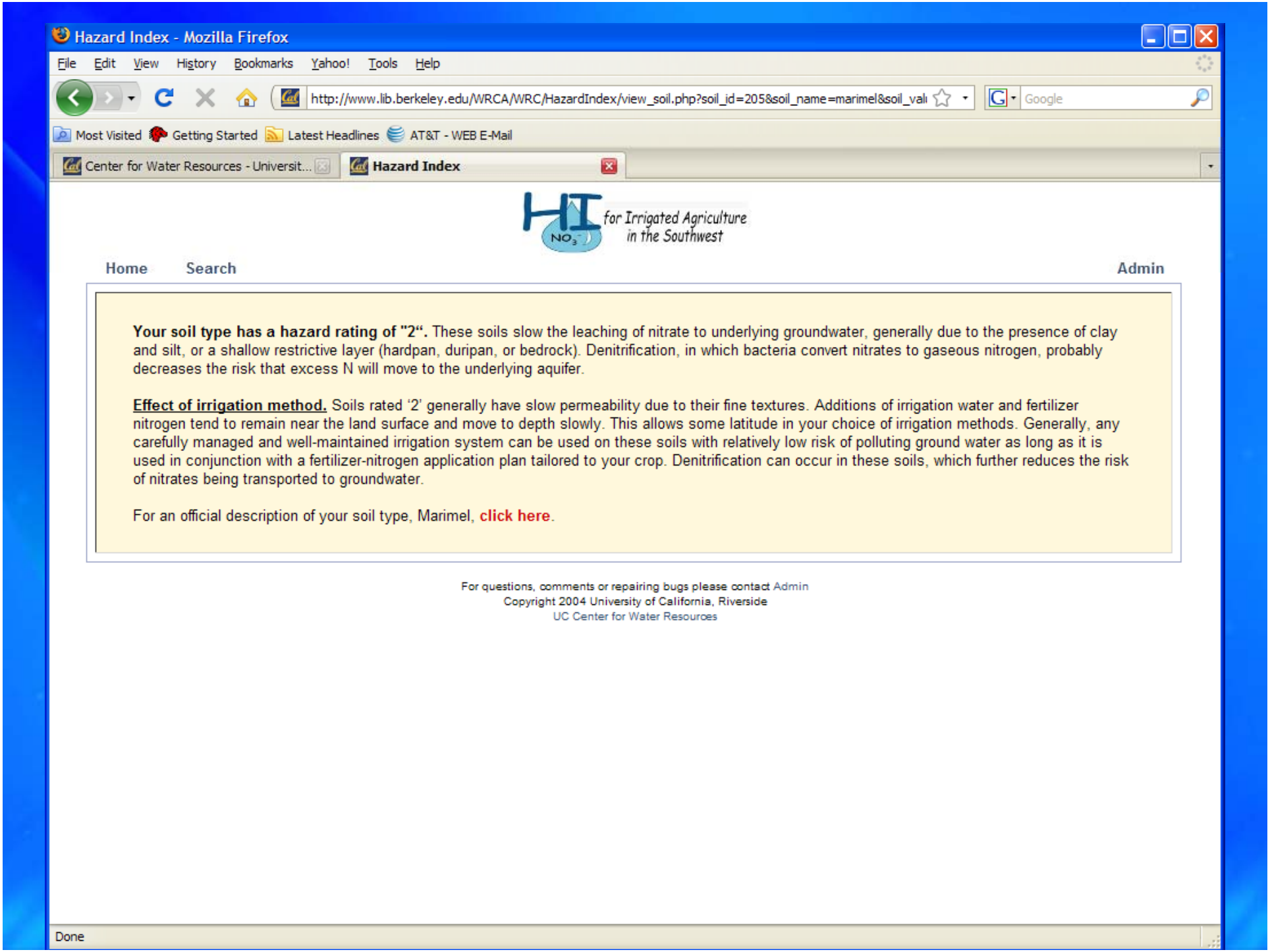
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Your soil type has a hazard rating of "2". These soils slow the leaching of nitrate to underlying groundwater, generally due to the presence of clay and silt, or a shallow restrictive layer (hardpan, duripan, or bedrock). Denitrification, in which bacteria convert nitrates to gaseous nitrogen, probably decreases the risk that excess N will move to the underlying aquifer.
Effect of irrigation method. Soils rated '2' generally have slow permeability due to their fine textures. Additions of irrigation water and fertilizer nitrogen tend to remain near the land surface and move to depth slowly. This allows some latitude in your choice of irrigation methods. Generally, any carefully managed and well-maintained irrigation system can be used on these soils with relatively low risk of polluting ground water as long as it is used in conjunction with a fertilizer-nitrogen application plan tailored to your crop. Denitrification can occur in these soils, which further reduces the risk of nitrates being transported to groundwater.
For an official description of your soil type, Marimel, click here.
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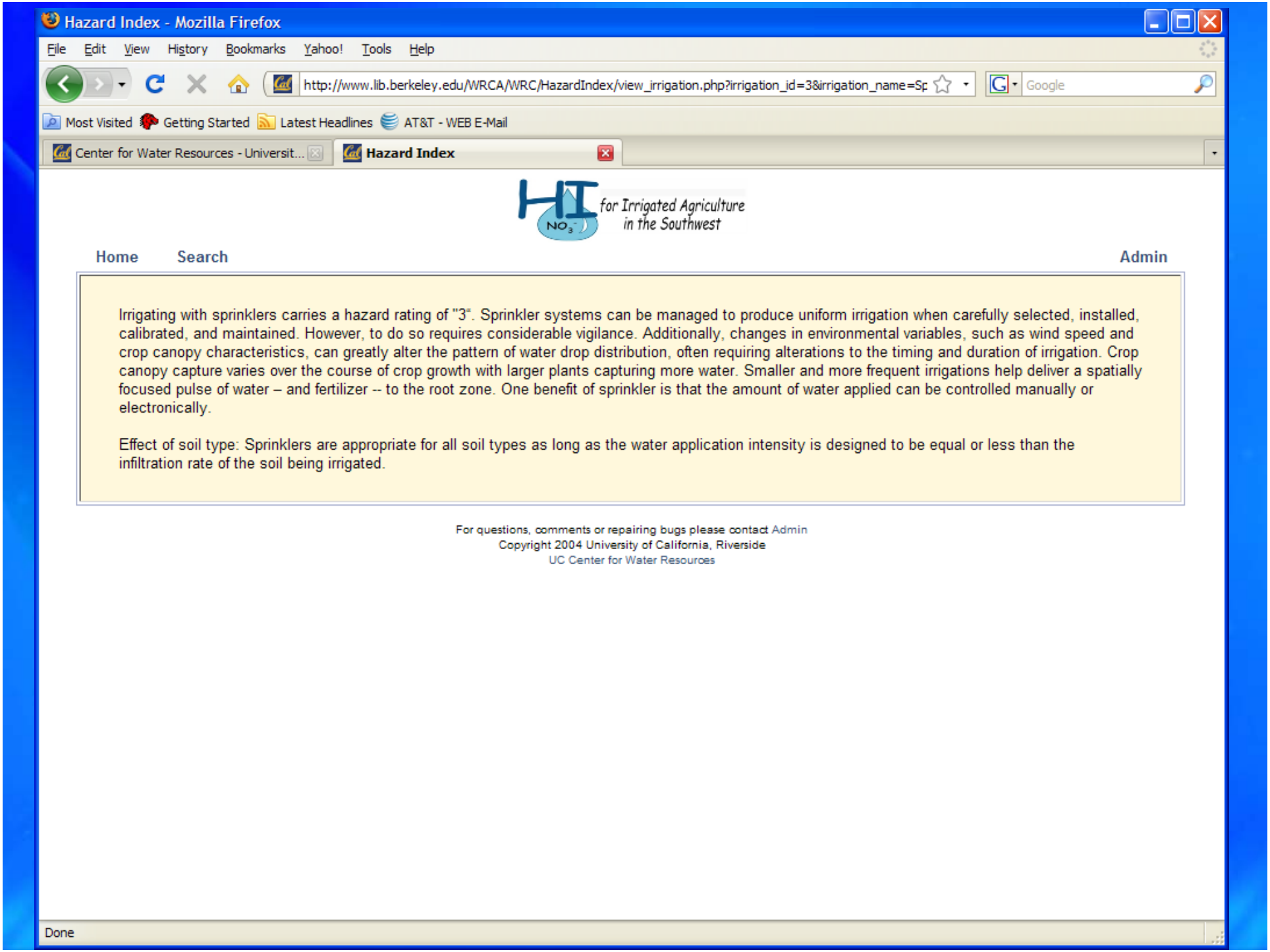
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Irrigating with sprinklers carries a hazard rating of "3". Sprinkler systems can be managed to produce uniform irrigation when carefully selected, installed, calibrated, and maintained. However, to do so requires considerable vigilance. Additionally, changes in environmental variables, such as wind speed and crop canopy characteristics, can greatly alter the pattern of water drop distribution, often requiring alterations to the timing and duration of irrigation. Crop canopy capture varies over the course of crop growth with larger plants capturing more water. Smaller and more frequent irrigations help deliver a spatially focused pulse of water – and fertilizer -- to the root zone. One benefit of sprinkler is that the amount of water applied can be controlled manually or electronically.
Effect of soil type: Sprinklers are appropriate for all soil types as long as the water application intensity is designed to be equal or less than the infiltration rate of the soil being irrigated.
For questions, comments or repairing bugs please contact Admin
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