EW01-010

APPENDIX C

Contents

July 2004

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Procedure for analysis

Appendix C was developed using the database of results from collected fecal samples for the period of December 1997 to July 2003. The analysis were performed by the Grazing Animal Nutrition Lab at Texas A&M University using Near Infrared Reflective Spectroscopy and the Nutritional Balance Analyzer. The following procedure was used in the MLRA evaluation.

1. Fecal Sample collected from herds and mailed to GANLab.
2. Sampled analyzed and results were forwarded to range specialist.
3. Range specialist provided information to producer and data was used in completed case studies.
4. Database for period of December 1997 to July 2003 was assembled.
5. Samples were assembled by MLRA region and evaluations were completed on crude protein, digestible organic matter.
6. A general characteristic of each MLRA was completed.
7. Evaluations were completed on maximum and minimum on a monthly average for applicable samples in each MLRA.
8. Plots using excel program smooth plots were developed.
9. Recommendation and finding were developed for each MLRA.
10. Case studies were used to verify gains/losses, herd conditions, etc. and applicability of NUTBAL findings.
11. Results are in following write up on each MLRA.
12. Appropriate technical specialist reviewed findings and results.

Order of information for each MLRA with adequate data

1. Write up summary of MLRA locations and sample results.
2. Plot of crude protein and digestible organic matter.
3. Characteristic table at end of MLRA information.

MLRA 4B – Coastal Redwood Belt

MLRA 4B consist of varying topography from the Pacific Ocean coast plains to the steep mountainous areas in Northern California. The MLRA area consists of varying vegetation from tidal vegetation to Coastal Range to redwood, Douglas fir and tanoak. Refer to Table A for general characteristics of the unit.

The sample areas in which the NUTBAL software program was used was located in the California subregions of 4B.4 and 4B.8. Native vegetation types present at the sample locations were of the Purple needlegrass series, Foothill needlegrass series, and introduced annuals and perennials. Introduced grasses include irrigated species of brome, fescue, timothy, and clovers. Areas are influenced by summer fog.

Evaluations were conducted at three locations over a 3-year time span. NRCS and Cooperative Extension personnel collected fecal samples. Results using the NIRS analysis performed at the Texas A&M University GANLAB providing percent of dietary crude protein (CP), digestible organic matter (DOM), nitrogen and phosphorus. Technical assistance was provided to the ranchers to assist in data interpretations and findings. Results show the dietary crude protein varied from a high of 15.75 to 18.1 percent occurring during the months of March through June and a minimum of 7.95 to 8.4 % in the month of September. (Refer to Figure C-2, page 6) DOM varied from a high of 72.37 to a low of 58.19. (Figure C-2)

A case study was completed with the rancher using the NUTBAL software program. Both a low elevation herd and a high elevation herd were evaluated for CP, DOM and weight gain. Finding reflected the cattle were losing weight during the period of low CP.

Conclusions

- The NIRS fecal testing seems to accurately show the trends in diet quality. The crude protein and digestible organic matter of forages are predicted to meet livestock needs in most cases. It appears that during the months of August through December CP is deficient to maintain desired weigh gains.
- For MLRA area adequate crude protein is available for the period of January through July. Time of winter and spring rainfall and associated temperature determine actual period of energy available from vegetation.
- The NUTBAL program elements reflecting environment conditions need to be carefully considered. The presence of summer fog may effect this aspect of the program and may impact the accuracy of weigh gain predications of the program
- NIRS sampling and the NUTBAL computer program can be effective in assisting ranchers and producers in determining diet quality available.
- Further study is needed to analyze the weigh loss/gain projections.

Figure C-1: Plot of Crude Protein and Digestible Organic Matter MLRA 4B for period of December 1999 to June 2003.

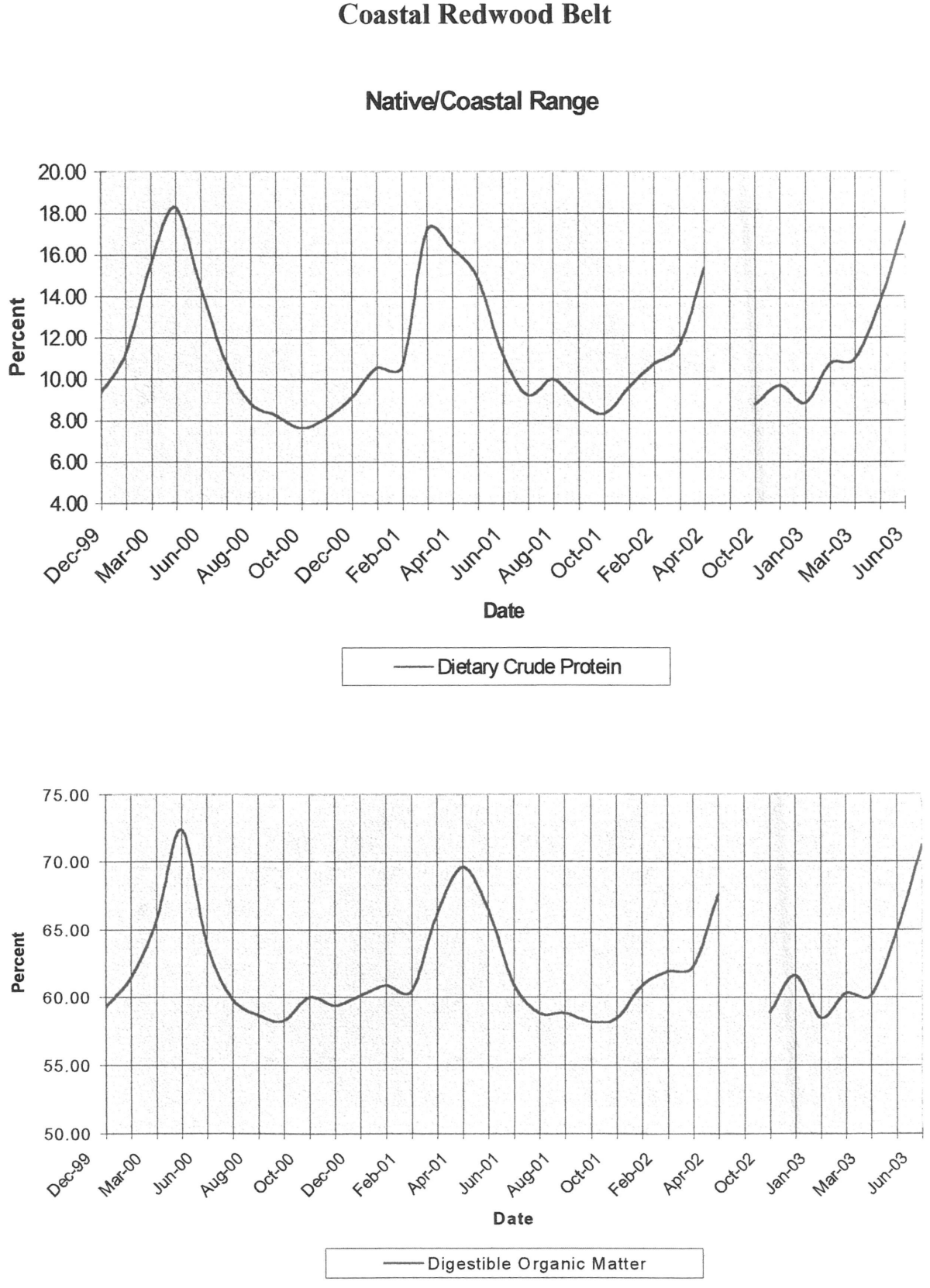
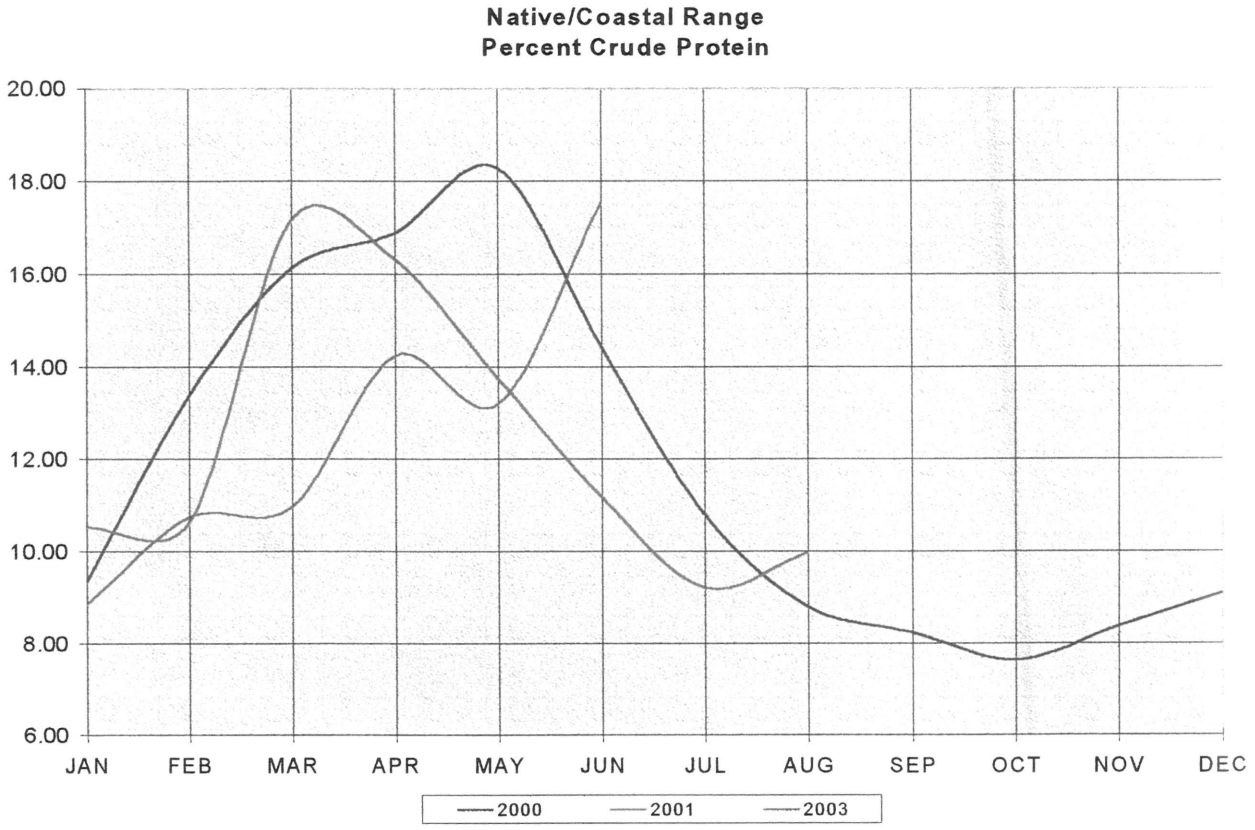
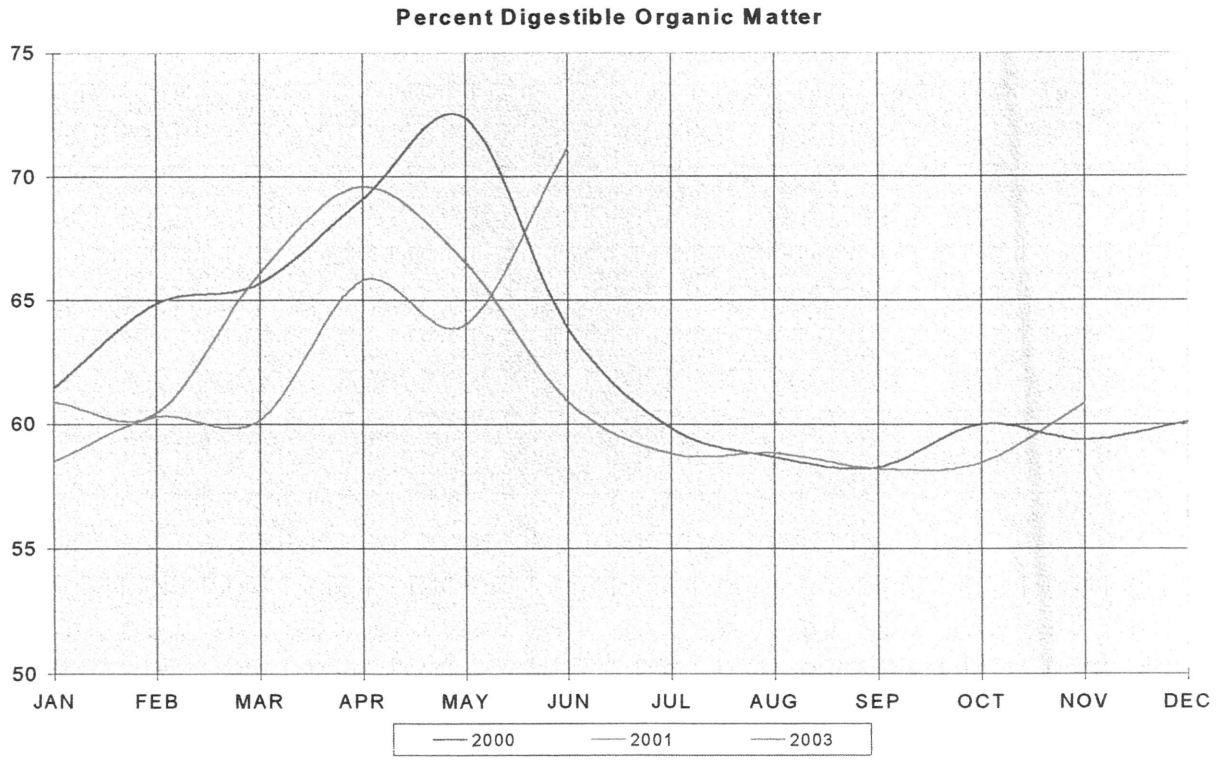


Figure C-2: Annual plot of Crude Protein and Digestible Organic Matter MLRA 4B





MLRA 15 - Central California Coast Range

MLRA 15 is the interior part of the Coast Range of California. It is inland from the coast and is far enough that climate is modified only slightly by marine influence. Refer to Table A for general characteristics of the unit.
The sample areas in which the NUTBAL software program was used were located in subregions 262An, 263Aj, 261Ai, and M262Aj. Three of the sample area vegetation was predominately the purple needlegrass series, annual grasslands and introduced annual and perennial grasses. Another site was predominately annual grasses and meadow planting in a dairy operation.

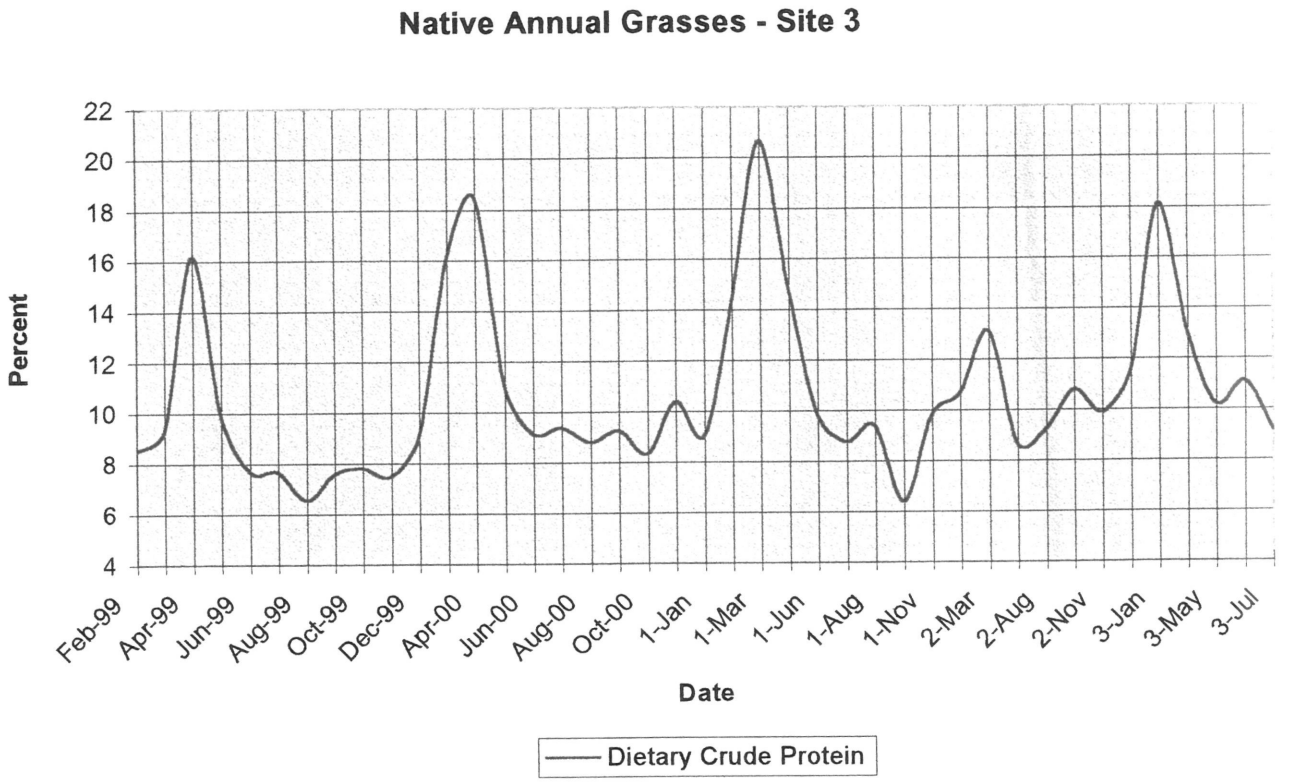
NRCS and Cooperative Extension personnel conducted evaluations at 4 locations over a 4-year period. Results using the NIRS analysis performed at the Texas A&M University GANLAB provided percent of dietary crude protein (CP), digestible organic matter (DOM), nitrogen and phosphorus. Technical assistance was provided the rancher to assist in data interpretations and findings. Results showed crude protein values with a high of 20.65% with an average high of 18.37% during the months of January to March. Timing of fall and winter rains determines the month of highest CP. Lowest value of CP was 6.37% in September of 2001. Average low value of CP for the period of June through October was 7.44% in 1999, 8.93% in 2000, 8.16% in 2001, and 10.01% in 2002. These values were for the southern range areas. In the northern regions with a single year of evaluation the maximum CP was 18.86 in March while the minimum vale was 7.19% in June.

The DOM evaluation reflected a maximum of 69.91% in March and a minimum value of 56.31% in October for the southern area while the northern segment had a high value of 74.48% in March with a low of 58.50% in June.

Conclusions

- The NIRS fecal testing seems to accurately show the trends in diet quality. The CP and DOM levels are predicted to meet the livestock needs in most cases. The summer period of June through October CP maybe deficient to maintain desired weight gains and nutrient levels.
- For MLRA the annual grasses and native vegetation provides adequate CP and DOM for the period of January through May. Time of fall and winter rains and associated temperatures determine the actual period of energy available from vegetation.
- The timing of rains has much more influence in the southern section of the MLRA. If low rainfall occurs a lower value of CP and DOM result. The year 2001-2002 reflect this with the maximum CP only being 13.10% with only 3 months in excess of 10% CP. The location of the ranch and elevation affects the vegetation energy level as reflected in CP. This is reflected in the 2003 data. A plot of 3 location shows one with maximum CP occurring in January, a second with high values from February through May and the third with a maximum value in March. This variation appears to be a result of timing and quantity of rainfall and associated temperature regimes.

Figure C-3: Plot of Crude Protein and Digestible Organic Matter MLRA 15 for period of February 1999 to August 2003.



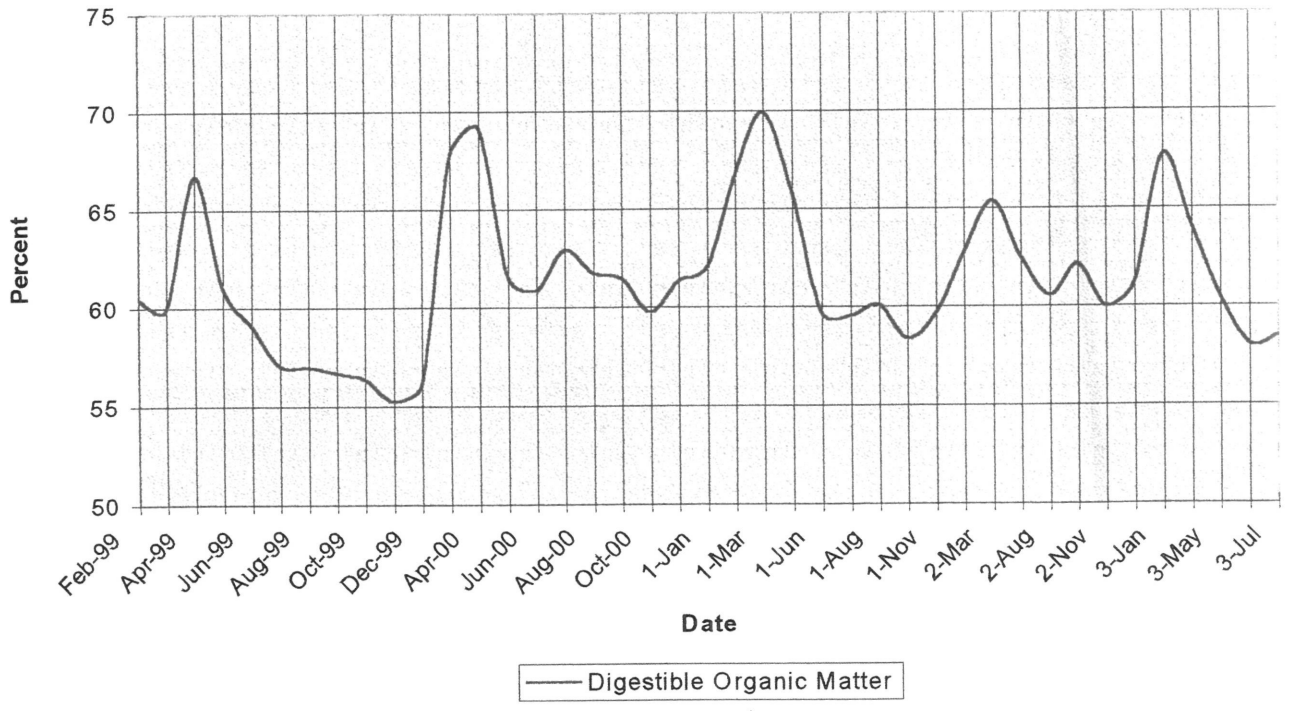
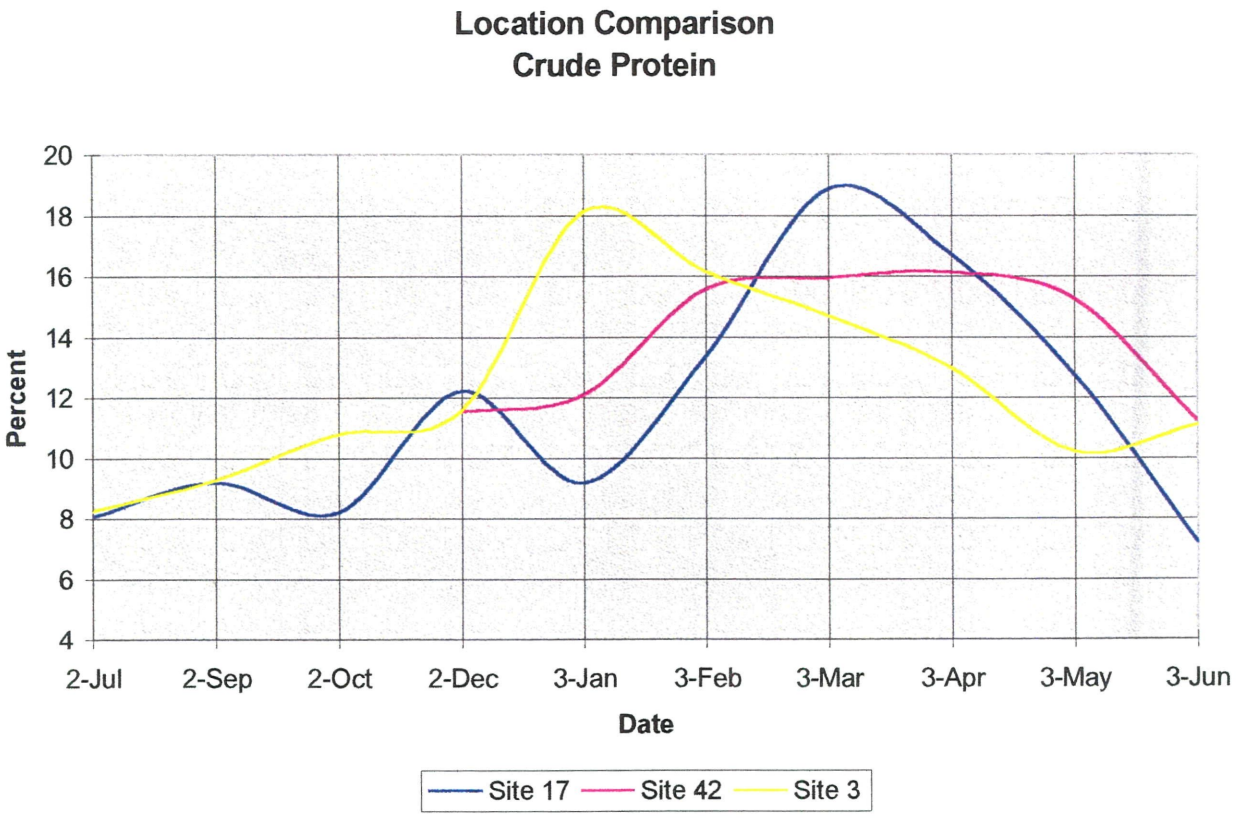


Figure C-4: Plot of three different site locations with in MLRA 15



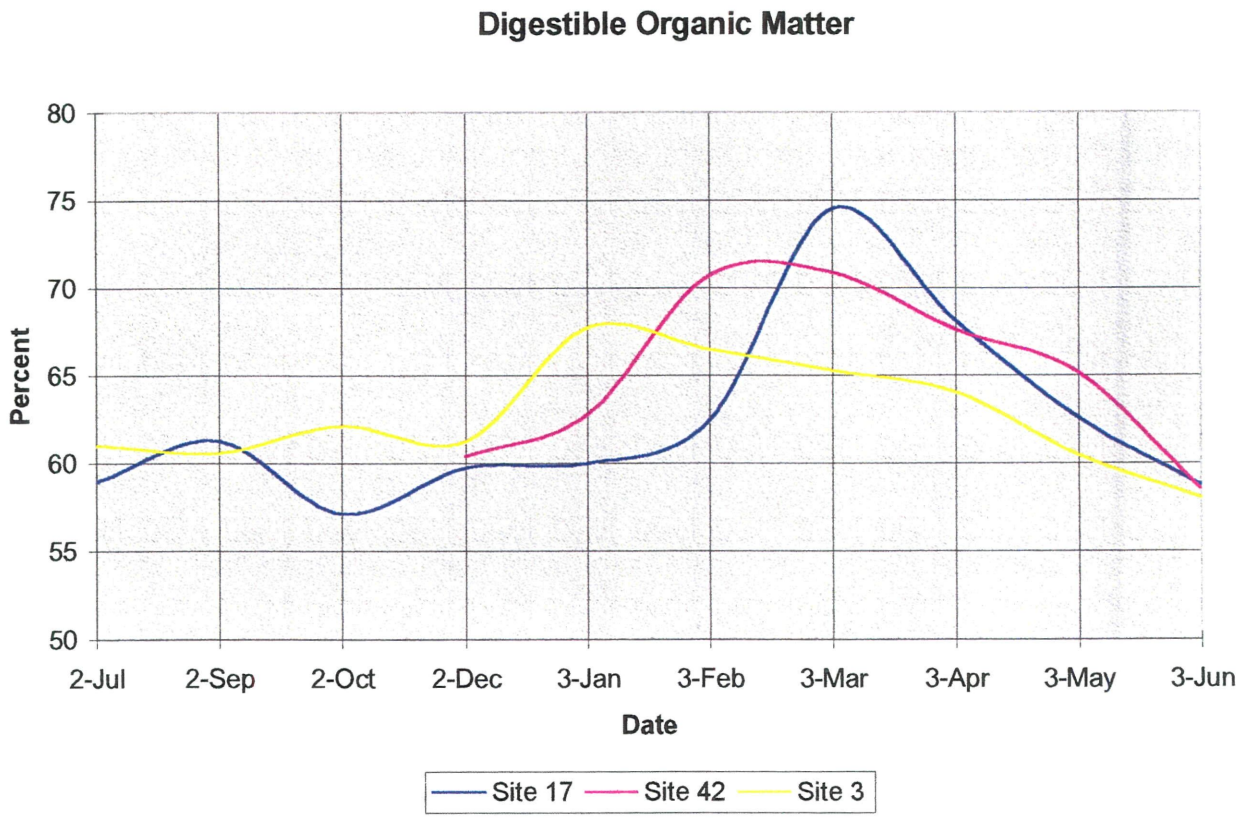
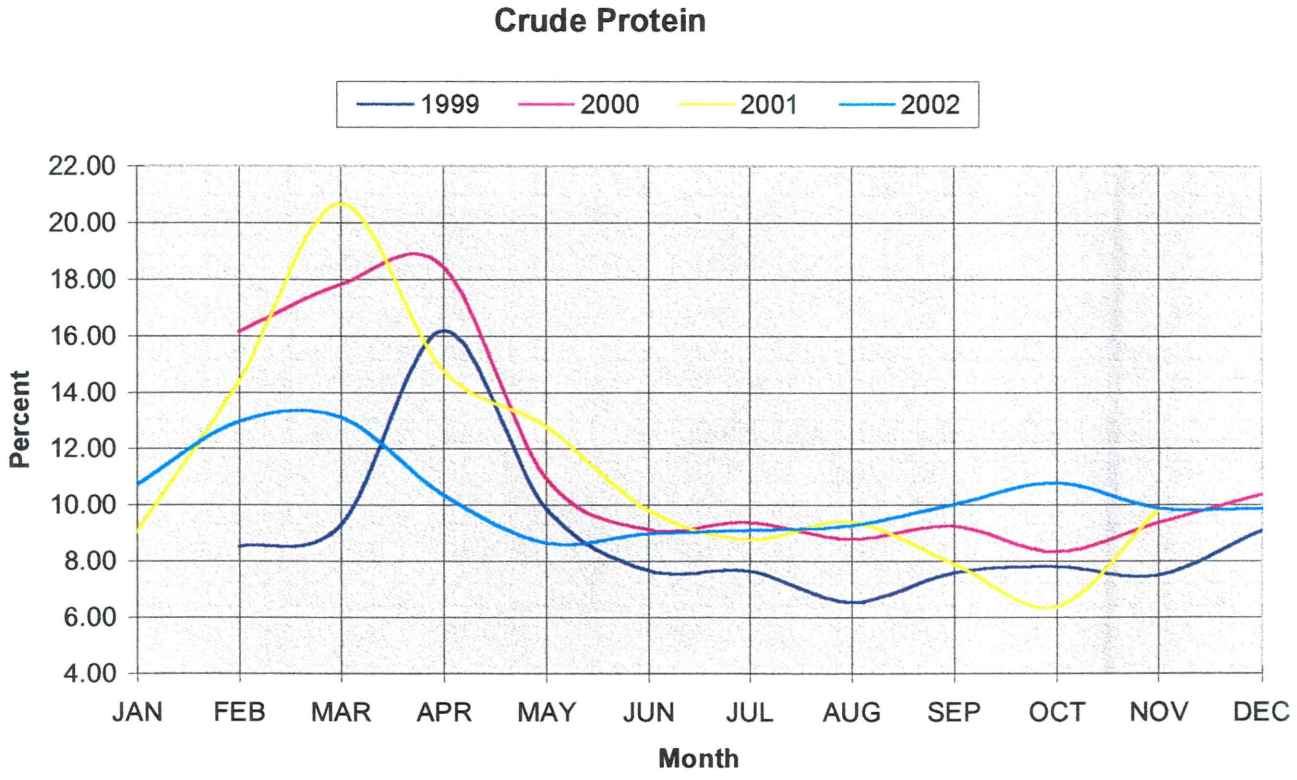
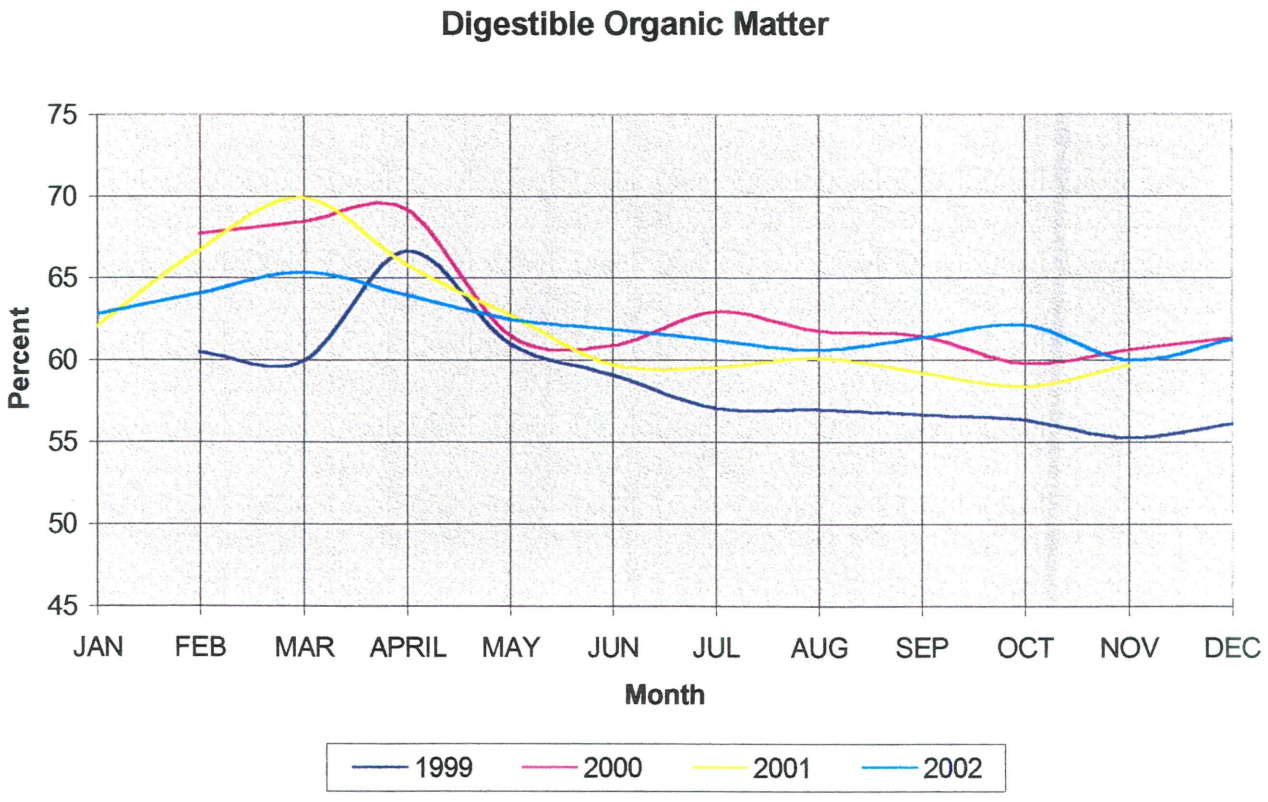


Figure C-5: Annual plot of Crude Protein and Digestible Organic Matter MLRA 15
California Central Coast Range





MLRA 17 – Sacramento and San Joaquin Valleys

MLRA 17 is the Sacramento and San Joaquin Valley areas of California. Summers are hot and dry and winters are mild. Oceanic influence on climate is slight in the middle of the Great Valley. It is inland from the coast and is far enough that climate is modified only slightly by marine influence from air flow through the Carquinez Sraights but become negligible at the north and south ends of the valley. The MLRA is composed of 23 subunits. Refer to Table A for general characteristics of the region.

The sample areas in which the NUTBAL software program was used were located in the northern Sacramento region and include subregions 17.CA1 and 17.CA2. These units are between the hills to the west and the western margin of the valley or are the gently sloping terraces and alluvial plains along the eastern edge of the valley. Soil temperature regime is thermic; soil moisture is xeric. Common vegetation series are needlegrass and California annual grassland; vernal pools are common. Three of the sample area vegetation included the species of softchess, wild oats, ripgut brome, rattail fescue, fillarie, and annual bluegrass with a population of Yellowstar Thistle and Medusahead. Two other sites sampled were predominately annual grasses and meadow planting.

NRCS and Cooperative Extension personnel conducted evaluations at 6 locations over a 3-year period. Results using the NIRS analysis performed at the Texas A&M University GANLAB provided percent of dietary crude protein (CP), digestible organic matter (DOM), nitrogen and phosphorus. Technical assistance was provided to the rancher to assist in data interpretations and findings. Results showed crude protein values with a high of 17.91% with an average high of 14.09% during the end of March and the 1st part of April. Lowest value of CP was 6.26% in November 1997. Average low value of CP occurs during the period of August through November/December. Values vary with an average of CP varying from 7.4% to 8%.

The DOM evaluation reflected a maximum of 68.48% in March and a minimum value of 55.81% in October.

Two case studies were completed which included grazing these vegetation types. Some ranches graze their herds from the periods of November through April and them move the herds to higher ranges. One case study included such a scenario while the other maintained the herd all year in the same general location. Calving occurs in December – January for those herds, which move to higher pastures while those that remain in the valley area, tend to calve during the spring.

Conclusions

- The NIRS fecal testing seems to accurately show the trends in diet quality. The CP and DOM levels are predicted to meet the livestock needs in most cases. The summer period of July through October CP maybe deficient to

maintain desired weight gains and nutrient levels, supplementation would be required.

- MLRA native vegetation normally provides adequate CP and DOM for the period of January through May. Time of fall and winter rains and associated temperatures determine the actual period of energy available from vegetation.
- In cases where the herd is maintained in the valley region throughout the year, supplementation will be required during the dry summer months. Depending on the rains it is possible that CP values can remain low until January.
- The location of the ranch and elevation plus the rancher's management can have a bearing on calving rate and success. It appears that a fall/winter calving time will maximize the energy for the cow during its period of highest demand.
- The use of planted vegetation such as barley, Sudan grass and other annual grasses can supply needed CP during the early growing period. If irrigation is available one should consider growing additional feed as a means of supplementation.

Figure C-6: Plot of Crude Protein and Digestible Organic Matter MLRA 17 for period of November 17 1997 to July 2000.

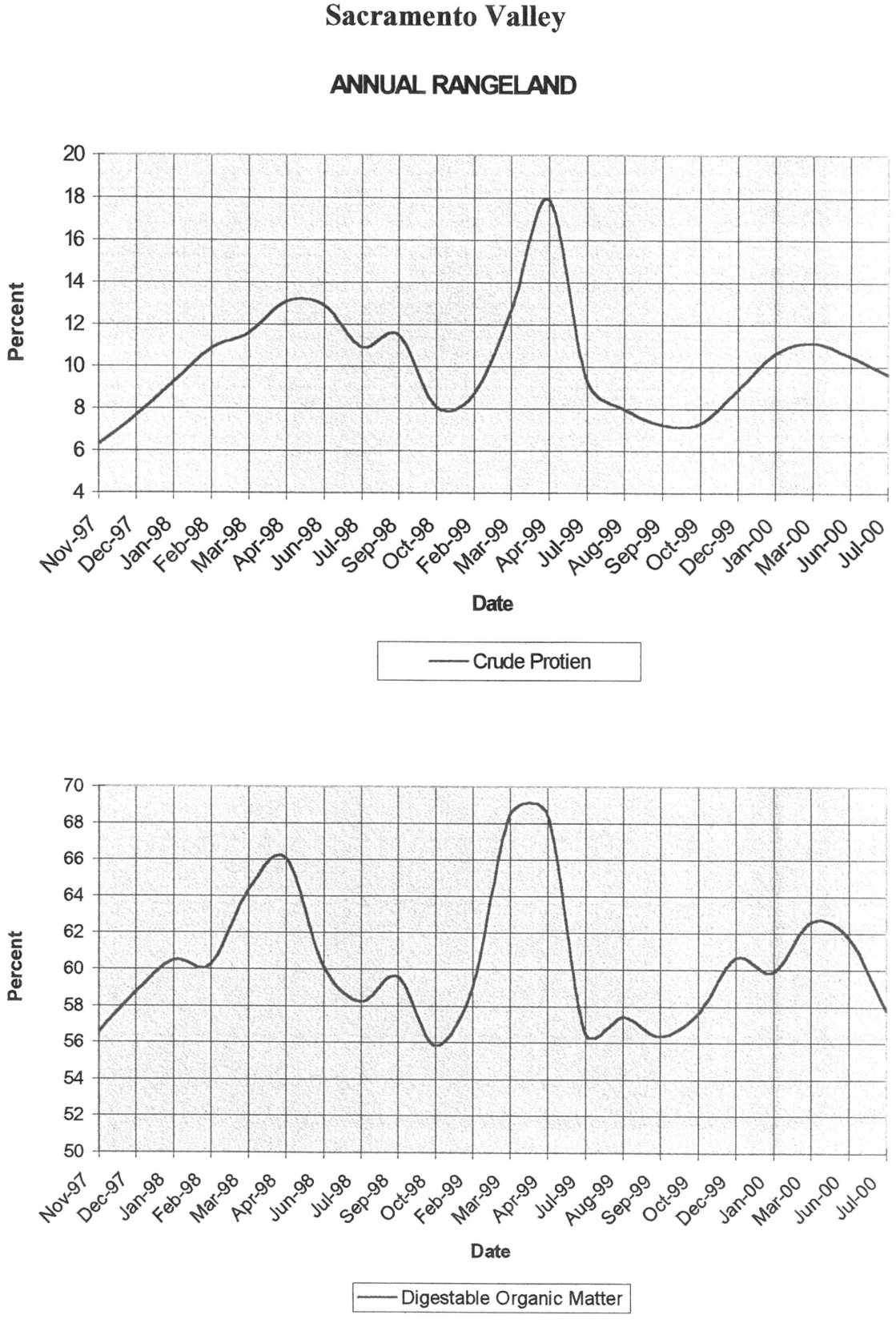
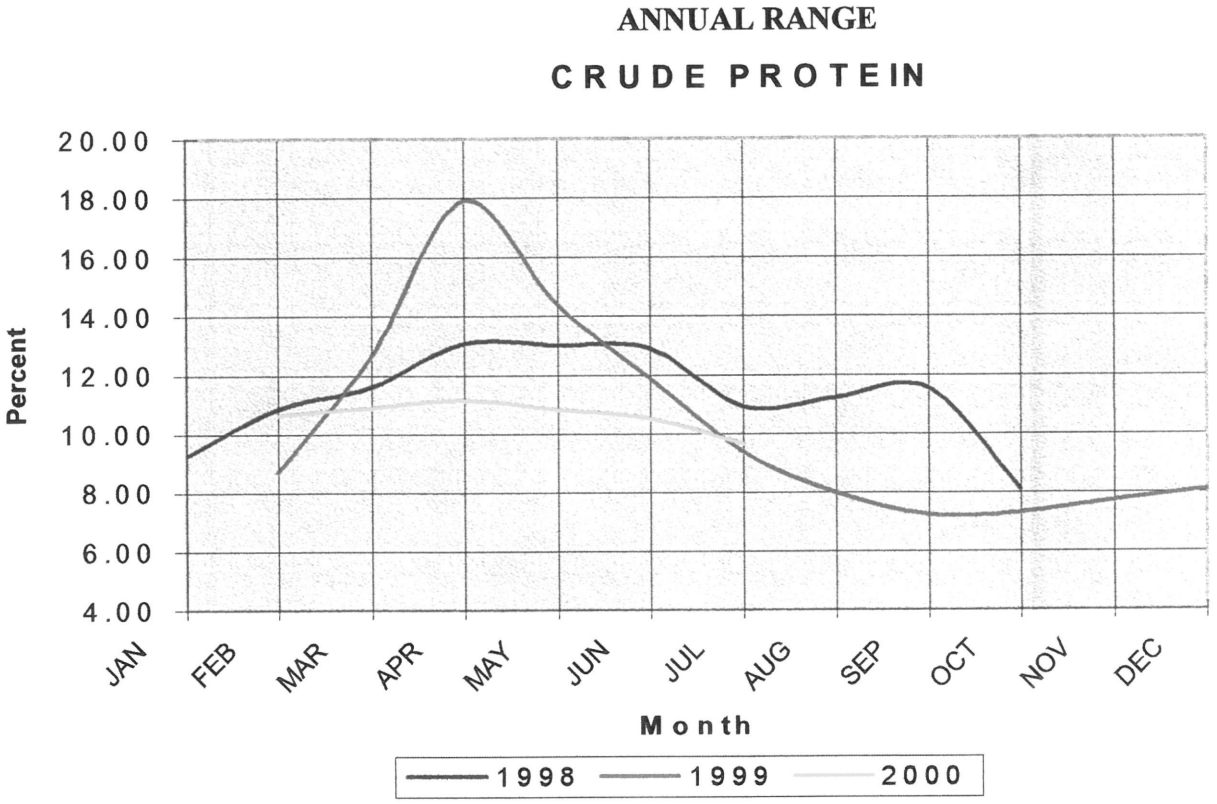
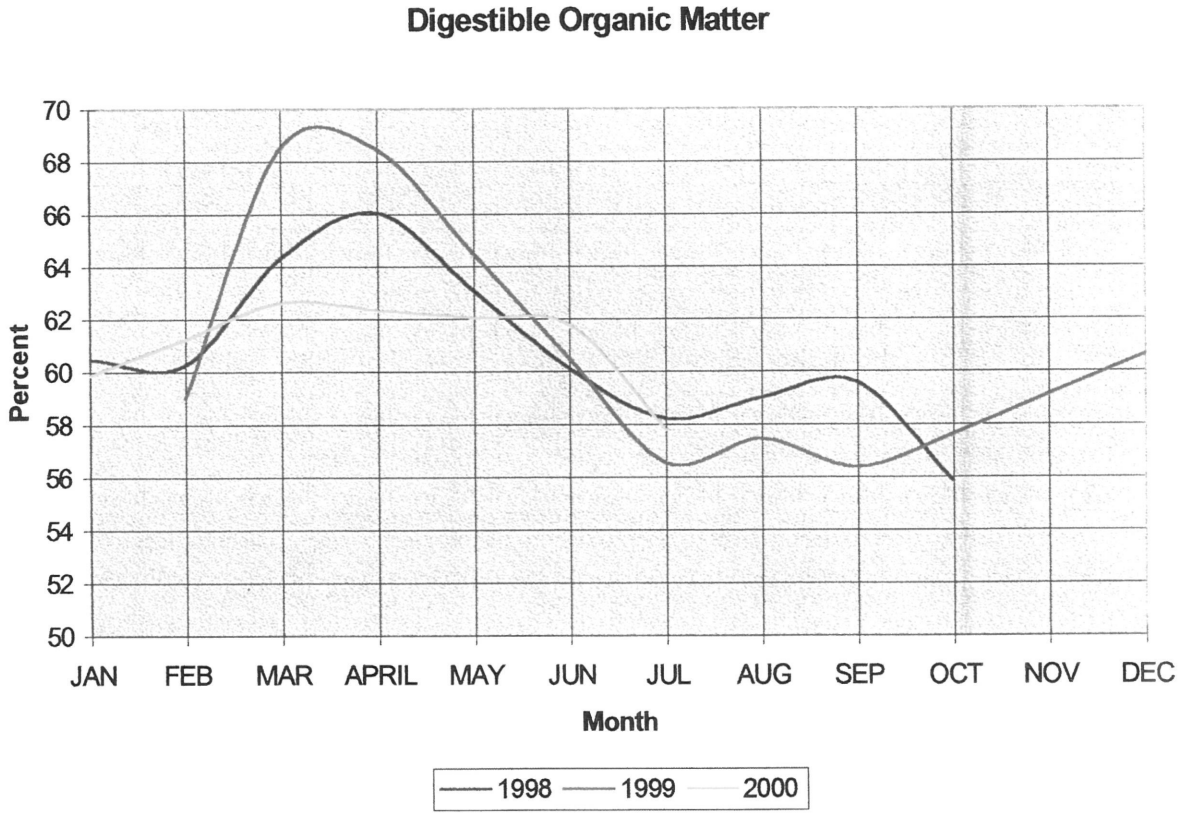


Figure C-7: Annual plot of Crude Protein and Digestible Organic Matter MLRA 17.





MLRA 18 – Sierra Nevada Foothills

MLRA 18 is the Sierra Nevada Foothills of California. Summers are hot and dry and winters are mild. The MLRA is composed of 6 subunits. Elevations vary from 200 feet to 2000 feet with precipitation ranges of 8 to 40 inches. Common exotic plants include Cheatgrass series, and Broom series. Invasive species such as yellow star thistle are a problem in the region. Introduced perennials grassland series are Kentucky bluegrass and Tamarisk series. Refer to Table A for general characteristics for the region.

The sample areas in which the NUTBAL software program was used were located in the Yuba County to Madera regions and include sub region 18.CA2. The sample sites are located in the moderately rolling to steep hills at the foot of the Sierra Nevada. Soil temperature regime is thermic; soil moisture is xeric. Runoff is rapid; streams drain to the Sacramento and San Joaquin Rivers. Common rangeland vegetation includes wildoats, ripgut brome, soft chess, rose clover, medusa head, and fillarie.

NRCS and Cooperative Extension personnel conducted evaluations at 4 locations over a 5-year period. Results using the NIRS analysis performed at the Texas A&M University GANLAB provided percent of dietary crude protein (CP), digestible organic matter (DOM), nitrogen and phosphorus. Technical assistance was provided the rancher to assist in data interpretations and findings. Results showed crude protein values with a high of 17.71% with an average high of 16.12% during the end of March and the 1st part of April. Lowest value of CP was 6.66% in September 1998. Average low value of CP occurs during the period of July through September. Values vary with an average of CP varying from 6.66% to 9.07%.

The DOM evaluation reflected a maximum of 72.67% in March and a minimum value of 55.47% in October.

This unit included the longest data set collected and was used as one of the validation site for the work of Angie Jinks in her evaluation on the use of Near-Infrared Resistance Spectroscopy (NIRS) as a means of determining the percent of CP and DOM on rangeland forages. Results of the finding are presented in the completed Thesis and summary papers. Findings indicate the accuracy of the results would improve if regional sample and curves were available for the sites in question.

The seasonal fluctuation of the values appears to be valid and should assist managers in the expectations of CP and DOM values available for their cattle.

Conclusions

- The NIRS fecal testing seems to accurately show the trends in diet quality. The CP and DOM levels are predicted to meet the livestock needs in most cases. The summer period of July through October CP maybe deficient to maintain desired weight gains and supplementation would be required.
- For this MLRA the native vegetation provides adequate CP and DOM for the period of January through June. Time of fall and winter rains and associated temperatures determine the actual period of energy available from vegetation.
- CP is the lowest from July to November and additional supplementation maybe required to meet the energy needs for the animals.
- The vegetation species present is and important element. In those ranges with a high percent of medusa head a low value of CP is available for the summer period.
- From a nutritional standpoint, it could be suggested that a December/January calving time is appropriate. In this case the native range can provide the needed energy required during milk production and breeding period.

Figure C-8: Plot of Crude Protein and Digestible Organic Matter MLRA 18 for period of December 1997 to May 2003.

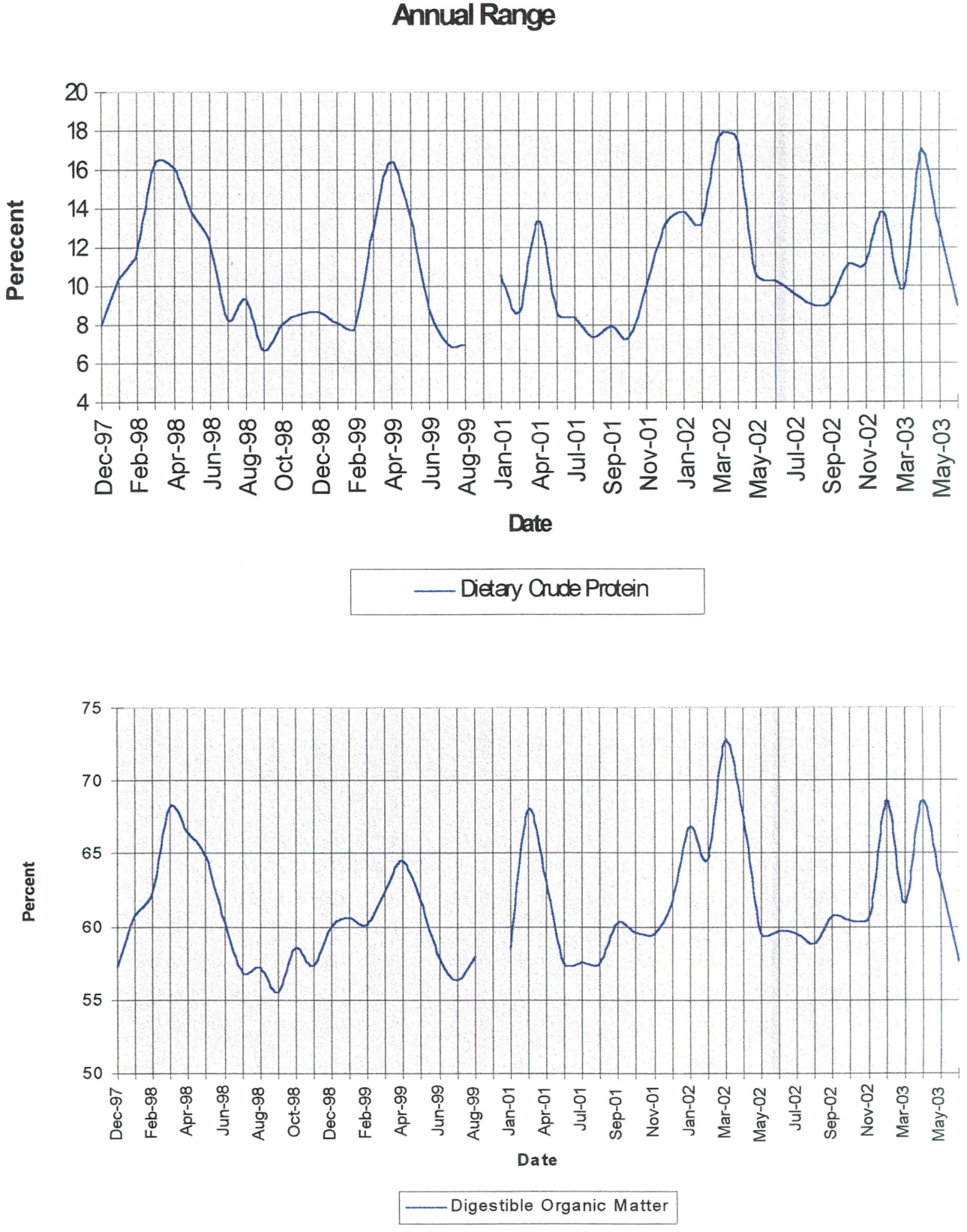
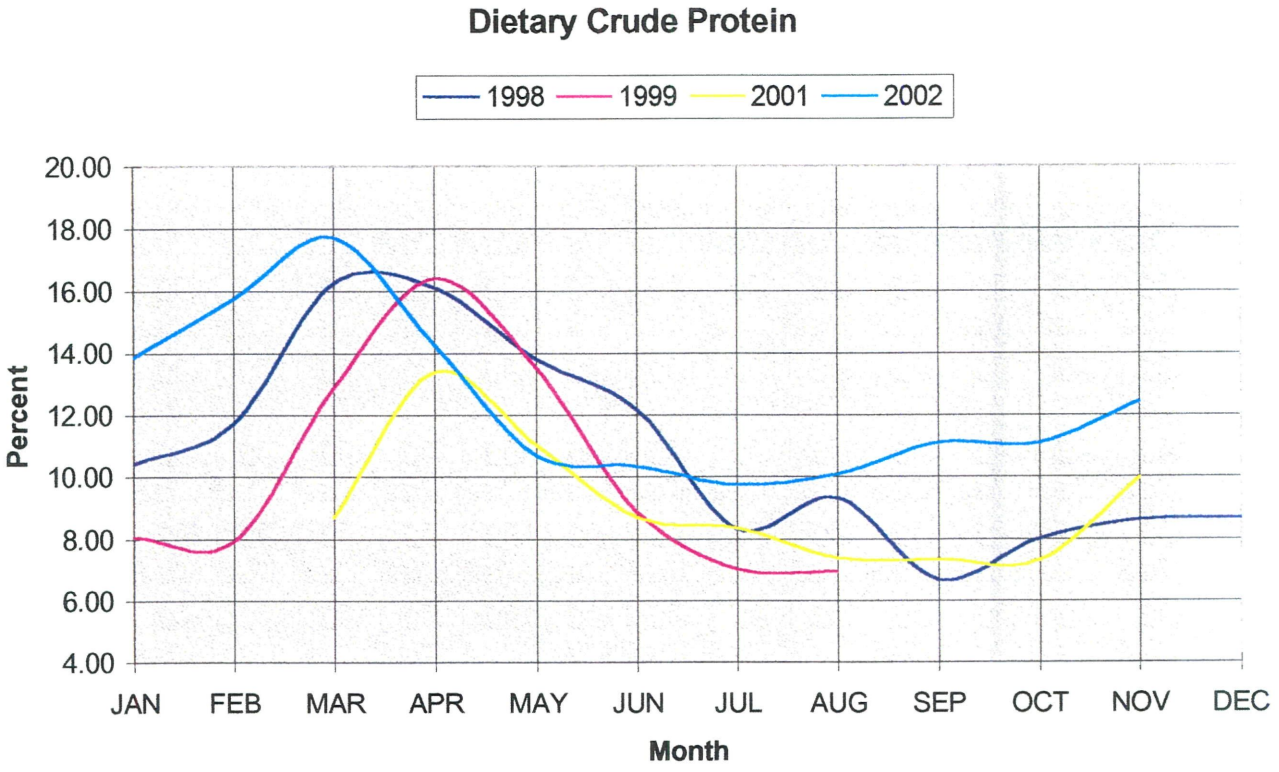
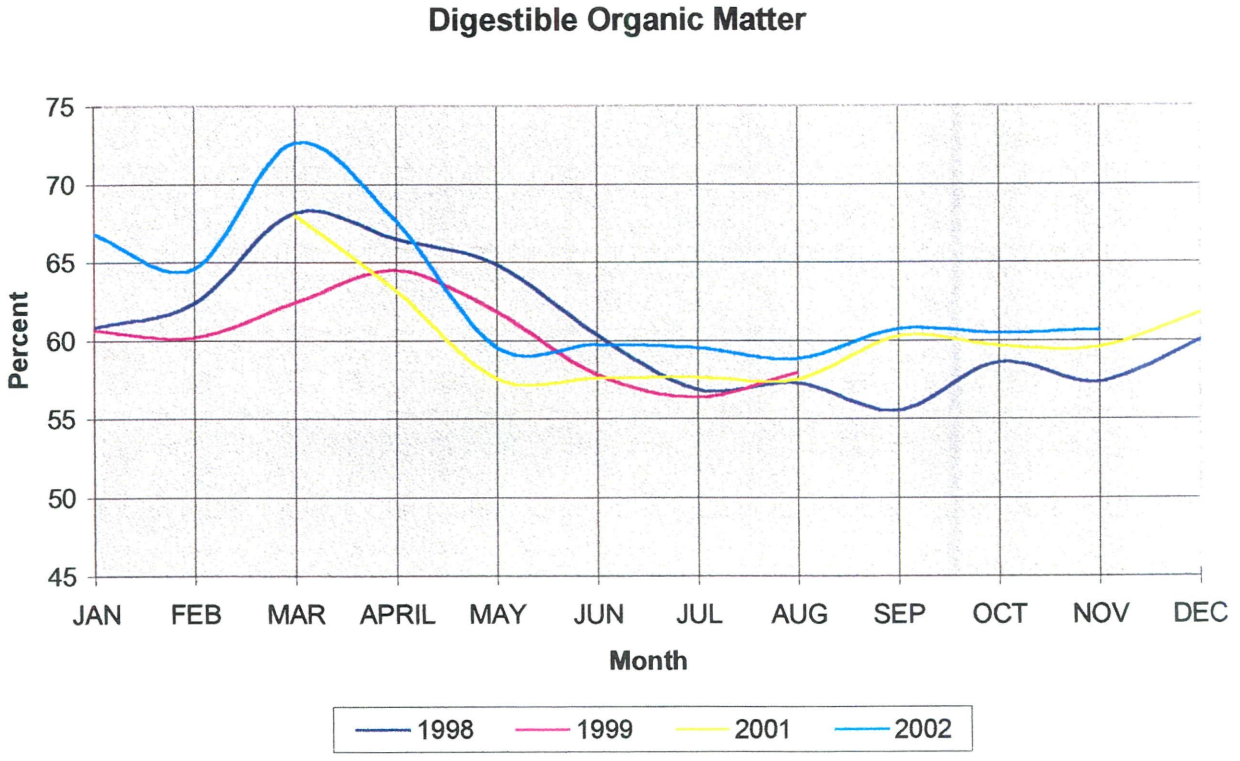


Figure C-9: Annual plot of Crude Protein and Digestible Organic Matter MLRA 18.





MLRA 20 – Southern California Mountains and Valleys

MLRA 20 includes mountains, hills, and valleys of the Transverse Ranges and Peninsular Ranges that are near the Pacific Ocean. Much of the MLRA is close enough to the Pacific Ocean for the climate to be modified moderately by marine influence. This MLRA is composed of 19 subunits, which vary from the Santa Maria area to the Mexican Border East of San Diego. Elevations vary from 300 feet to 11,500 feet with precipitation ranges of 6 to 40 inches. Refer to Table A for predominant natural vegetation communities present in the region.

The sample areas in which the NUTBAL software program was used were located in the mountain area of Ventura County and include sub region 20.CA10. The sample sites are located in the steep mountains, moderately steep to steep hills, and nearly level to gently sloping floodplain terraces and alluvial fans, between the Santa Clara River, Santa Monica Mountains, Oxnard Plain and San Fernando Valley. The climate is hot and subhumid and is modified greatly by marine air. Soil temperature regime is thermic; soil moisture is xeric. The mean annual precipitation is 16 to 20 inches and is practically rain. Mean annual temperature is about 52 to 62 degrees F. Runoff is rapid and all streams are generally dry during the summer. Common grassland vegetation series are California annual grassland. Species composition includes blando brome, soft chess, and filaree, wild oats and bur clover. Shrub lands include California sagebrush, California buckwheat series, coyote bush, Chamise series, mixed scrub oak, and coast live oak.

NRCS conducted evaluations at 4 locations over a one-year period. Results using the NIRS analysis performed at the Texas A&M University GANLAB provided percent of dietary crude protein (CP), digestible organic matter (DOM), nitrogen and phosphorus. Technical assistance was provided the rancher to assist in data interpretations and findings. Results showed crude protein values with a high of 14.97% during February through March. Lowest value of CP was 8.62% in September. .

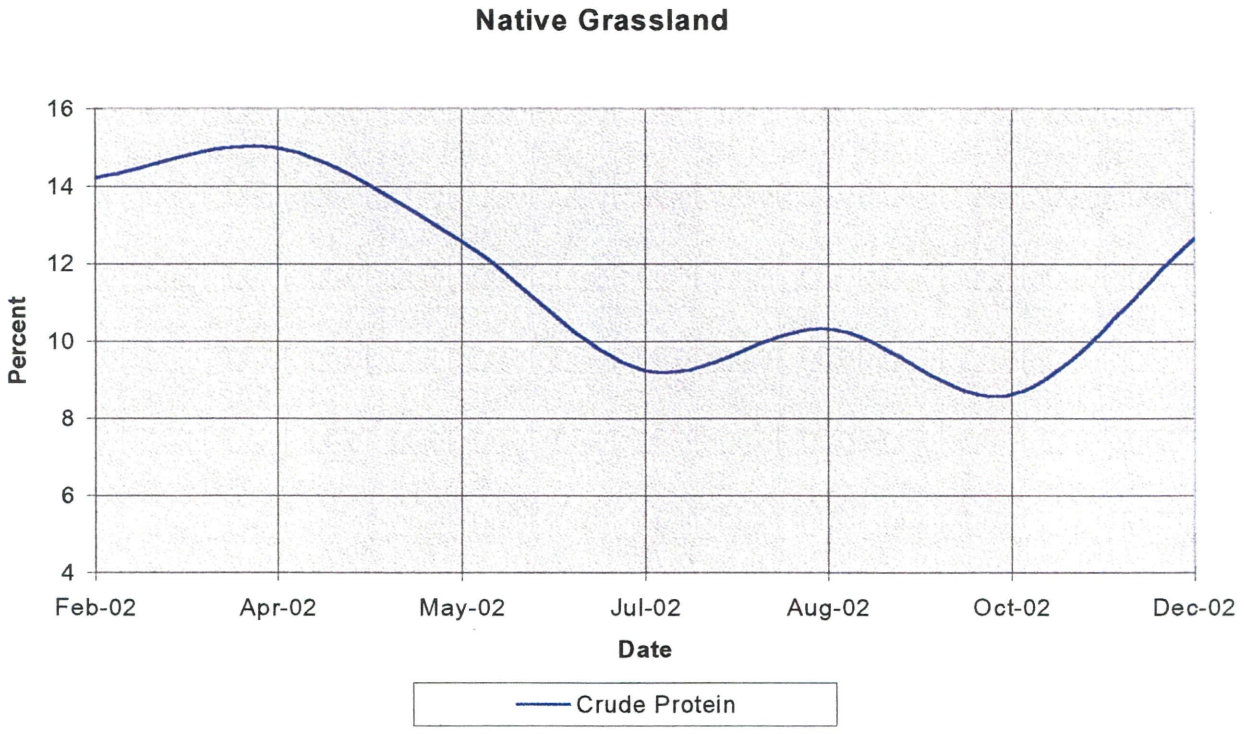
The DOM evaluation reflected a maximum of 64.94% in March and a minimum value of 55.47 in October.

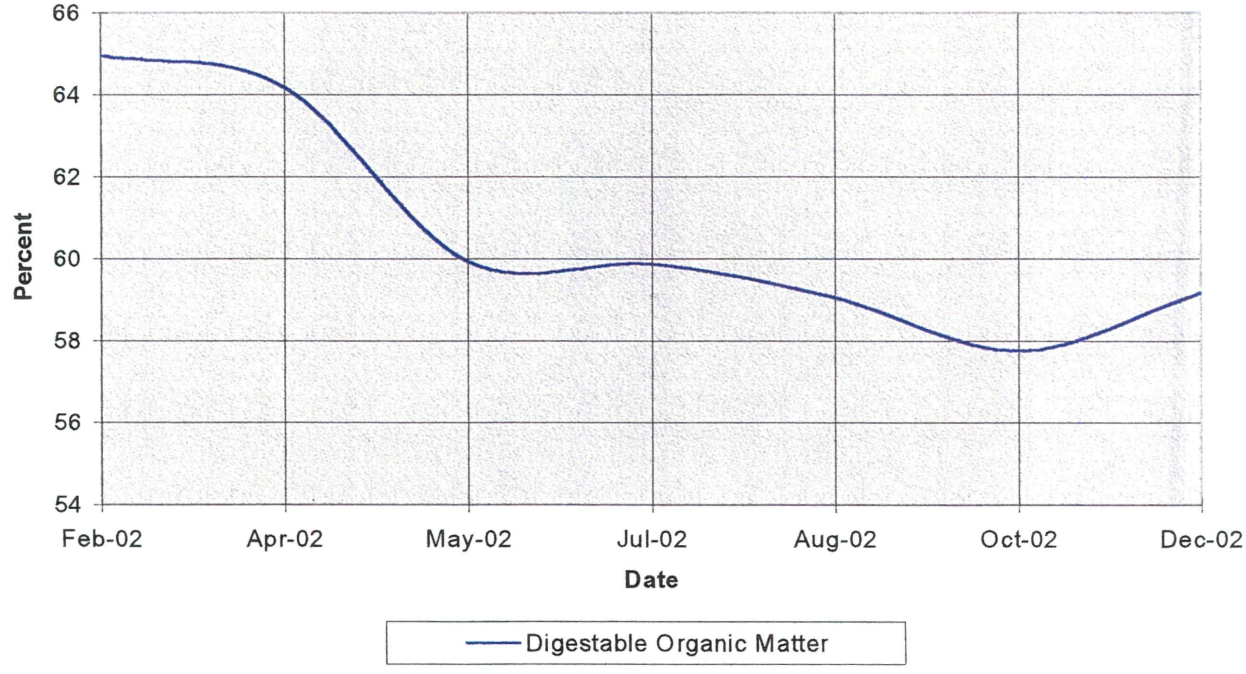
The sample sets for MLRA 20 cover only a 10-month period and were highly localized.

Conclusions

- The NIRS fecal testing seems to accurately show the trends in diet quality. The CP and DOM levels are predicted to meet the livestock needs in most cases.
- Additional testing is required to cover the complete MLRA as these samples are for only 1 year and are all located in only 1 sub unit.

Figure C-10: Plot of Crude Protein and Digestible Organic Matter , MLRA 20, for the period of February to December 2002.





MLRA 21 – Klamath and Shasta Valleys and Buttes

MLRA 21 corresponds to most of the Modoc Plateau. The MLRA has Northwesterly trending fault-block mountains and ridges with intervening basin-like grabens commonly interspersed with lakebed deposits, shield volcanoes, cinder cones or lava flows. The MLRA is composed of 30 subunits, which vary from the Oregon border from Goose Lake south to the Susanville area. Elevations vary from 3000 feet to 9,900 feet with precipitation ranges of 8 to 30 inches. Growing season is from 25 to 150 days. Refer to Table A for predominant natural vegetation communities present in the region.

The sample areas in which the NUTBAL software program was used were located in the Willow Creek area that is north of Susanville and include sub region 21.CA18. The sample sites are located in the faulted and eroded volcanic plateau with many volcanic hills, mountains and basins. Ranches in the region generally use annual range from December through May, native grass/sagebrush/mountain browse range from June through August and irrigated pasture from September through November. Elevation ranges from 4200 adjacent to Honey Lake to 7964 feet at Observation Peak. The mean annual precipitation is about 15 to 30 inches. Much of the precipitation is snow. Mean annual temperature is about 38 to 50 degrees Fahrenheit. The mean freeze-free period is from 50 to 125 days. Runoff from upland is rapid; much of it drains through faults in the basalt to the ground water reservoir, limiting overland flows of water and stream channels. Streams that flow from the area drain to either Honey Lake or the Madeline Plains. Grassland life forms include California oatgrass series, Ashy ryegrass series, Creeping ryegrass series, Idaho fescue series, Indian ricegrass series, Nebraska sedge series, Needle-and-thread series. Scrublands include Big sagebrush series, Bitterbrush series, Black sagebrush series, Low sagebrush series and Rubber rabbit brush series. Primary species composition in sample area for sagebrush grassland was Sandberg Bluegrass, Idaho fescue, and mountain browse made up of bitterbrush and mountain mahogany. Primary vegetation types on improved irrigated pastures were made up of Kentucky bluegrass and Fawn Tall Fescue, Orchargrass and clovers.

NRCS conducted evaluations at 3 locations over a 2-year period. Results using the NIRS analysis performed at the Texas A&M University GANLAB provided percent of dietary crude protein (CP), digestible organic matter (DOM), nitrogen and phosphorus. Technical assistance was provided the rancher to assist in data interpretations and findings. Samples were taken on annual and native range, meadow lands, cool season grasses, and irrigated pasture. Only the native/annual pastures had adequate information for analysis on a MLRA sub area. Almost all collected samples on the meadow, cool season grasses and irrigated pastures had CP value in excess of 10 percent.

Results from the native/annual range showed crude protein values with a high of 15.00% during April 1998. Lowest value of CP was 7.85% in August. Average for the 2 years was 13.86% in April with average low values of 8.54% for the period of August to February.

The DOM evaluation reflected a maximum of 67.87% in March and a minimum value of 55.26% in September.

A case study was completed on a ranch operating in the MLRA. The results indicate with managed grazing on all three-vegetation types adequate animal nutrition can be maintained. During the perennial grass, sagebrush range and mountain browse period (May through August) the cattle were in the late-gestation to calving cycle. The study shows the short green period on this range usually last till mid July. After that the vegetation dries quickly. Sampling showed that protein and energy content fall with vegetation maturation.

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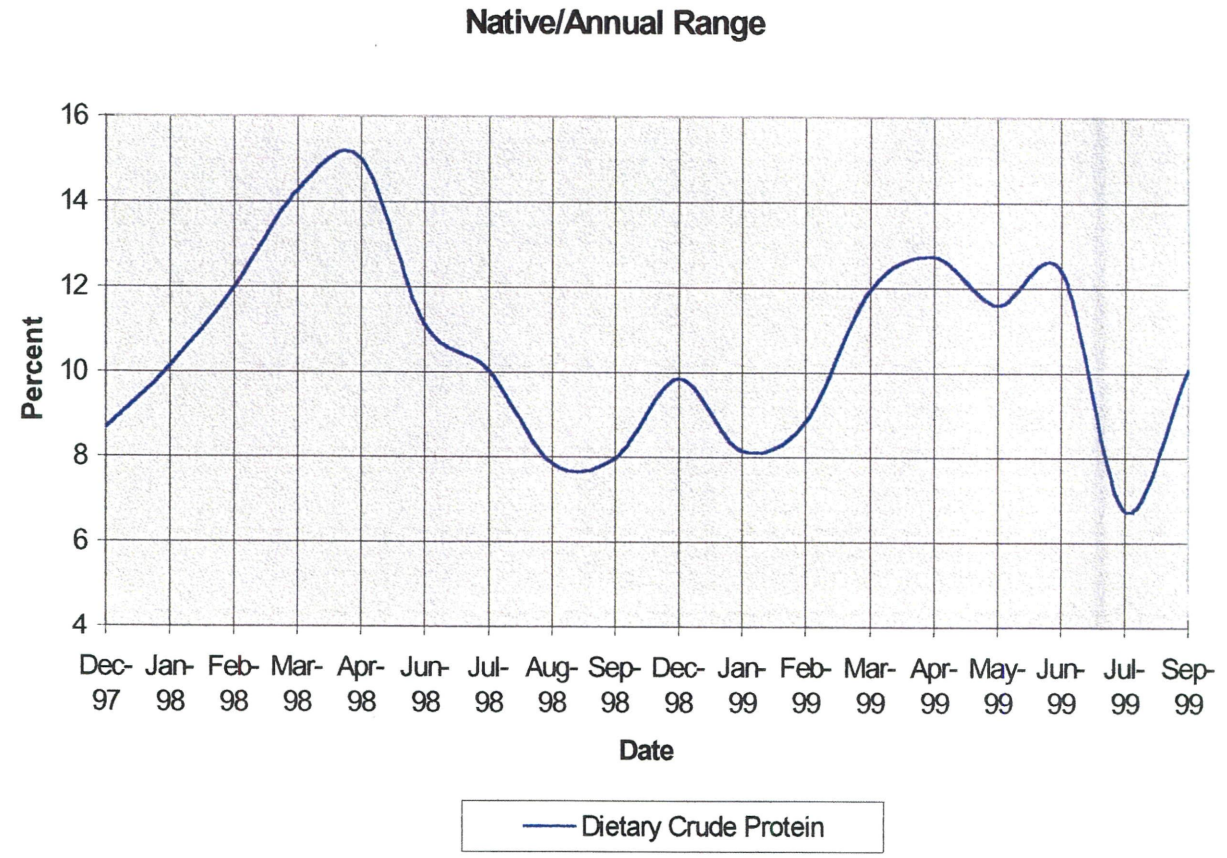
Conclusions

- The NIRS fecal testing seems to accurately show the trends in diet quality. The CP and DOM levels on annual range are adequate to meet the livestock needs for the period of January through May
- Native perennial grass, sagebrush range and mountain browse provides adequate CP and energy needs early in the season normally May through late July.
- Cattle tend to shift from herbaceous vegetation to mountain browse when herbaceous protein content falls below 7% CP.
- In order to maintain sufficient CP and energy levels grazing management is required including incorporation of annual gasses and irrigated pasture grazing units.
- Timing is critical when cattle are on annual range. When vegetation dries supplementation will be required to maintain the animals.
- This MLRA has little California annual grasslands and primarily cool season perennial native grasses.
- Case study and sample evaluation shows use of NUTBAL to be an effective tool for assisting ranchers in making management decisions.

Figure C-11: Plot of Crude Protein and Digestible Organic Matter, MLRA 21, for the period of December 1997 to September 1999.



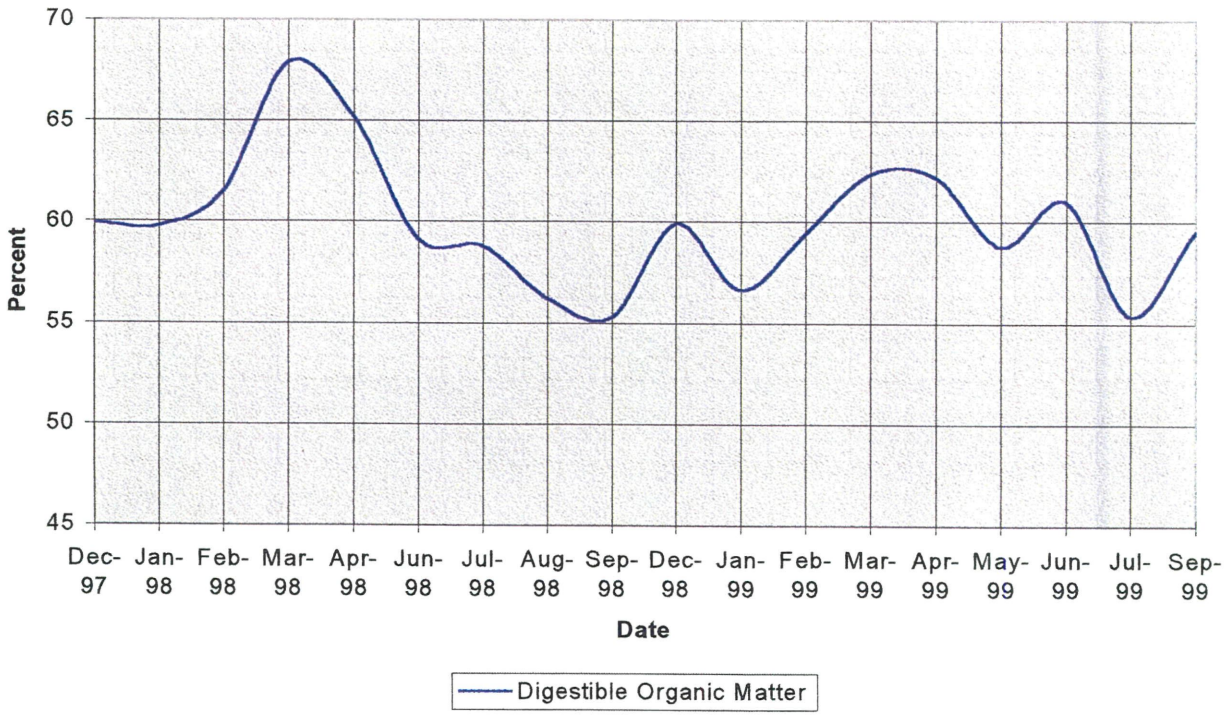
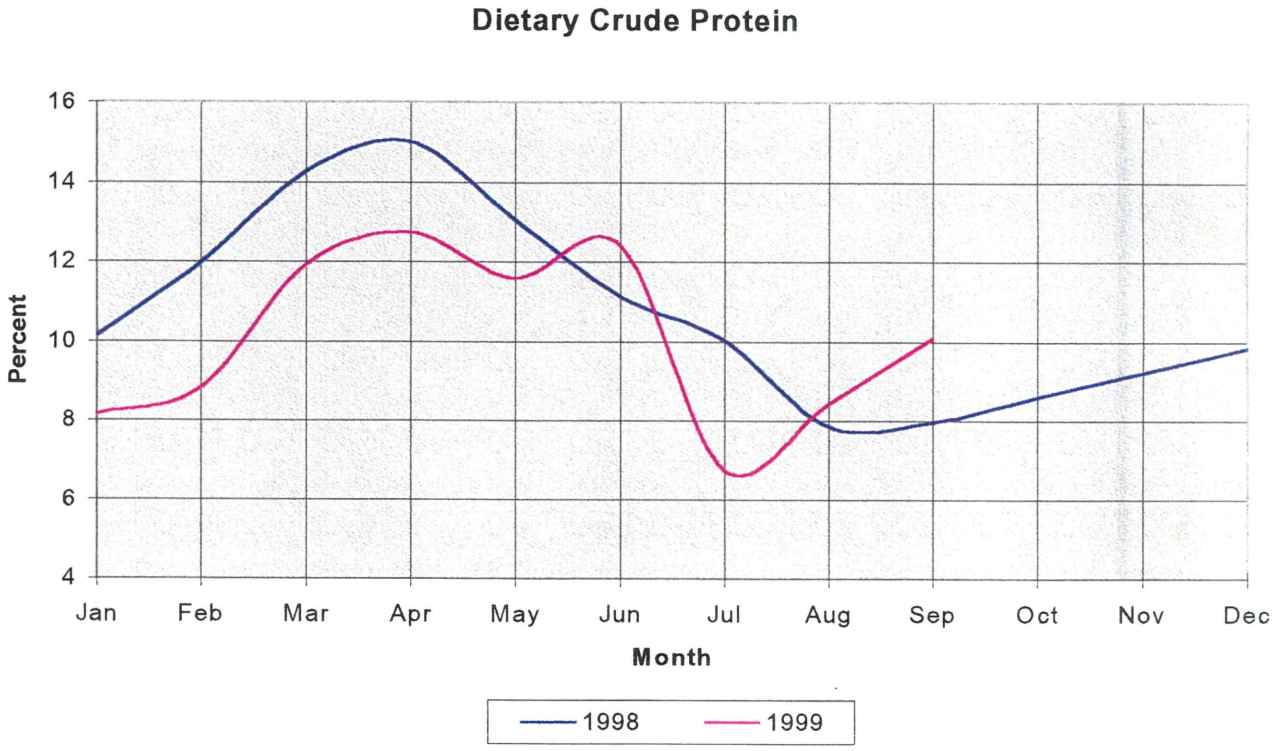
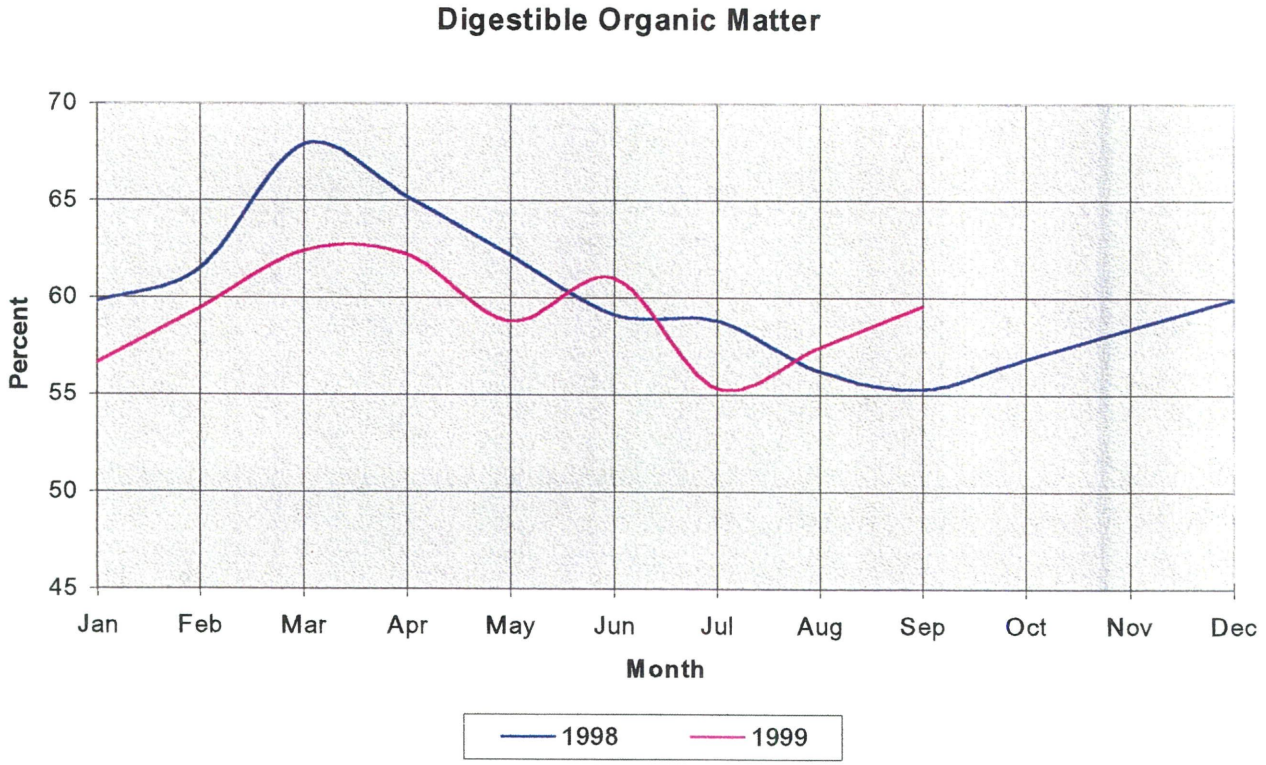


Figure C-12: Annual plot of Crude Protein and Digestible Organic Matter, MLRA 21





MLRA 22A – Sierra Nevada Mountains

MLRA 22A corresponds to the temperate to very cold parts of the Sierra Nevada, which is a north-northwest aligned mountain range, that is much steeper on the east than on the west side. The MLRA has many rapid flowing rivers and streams. The rivers flow west from the crest in deeply incised canyons with bedrock controlled channels to the Sacramento and San Joaquin Valleys. Rivers flowing east from the crest terminate in basins in the Mojave Desert, Mono, or Northwestern Basin and Range sections. There are numerous lakes and wet meadows associated with the glaciated areas above 5000 feet. The MLRA is composed of 26 subunits that run from northern Feather River to the Tehachapi – Piute Mountains in the south. Elevations vary from 1000 feet to 14,495 feet with precipitation ranges of 10 to 90 inches. Above 6000 feet it is mostly snow. Growing season is from 10 to 200 days. Refer to Table A for predominant natural vegetation communities for the region.

The sample areas in which the NUTBAL software program was used were located in the Greenville –Graeagle 22A.CA6 subunit in Indian Valley and sub unit 22A.CA12 Upper Foothills Metamorphic Belt near Placerville. The sample sites are located in the valley sections with the topography being relatively flat with gradually sloping side slopes. Steep wooded mountainsides surround the valleys. Most of the grazed lands consist of native and improved pasture species. Most of the area is flood irrigated through a series of field ditches. A large percent of the precipitation comes during the winter months. Cattle graze on the pastures with primary meadow species being fawn tall fescue, smooth brome, clover, orchardgrass, birsdfoot trefoil, reed canarygrass, meadow barley, timothy and Nebraska sedge. The herds grazed the pastures from April through mid November. After the growing season cattle were fed hay during the winter months which were grown locally. Elevation ranges were approximately 3500 feet with average precipitation of 25 to 30 inches. Much of the precipitation is snow. Mean annual temperature is about 45 to 55 degrees Fahrenheit. The mean freeze-free period is from 75 to 150 days. Runoff from upland is rapid but slow on the basin floor. Streams that flow from the area drain to the Sacramento Valley. Native Grassland life forms includes, California oatgrass series, Ashy ryegrass series, Idaho fescue series, Montana meadow habitat, Nebraska sedge series, and Needle-and-thread series.

NRCS conducted evaluations at 4 locations over a 3-year period. Results using the NIRS analysis performed at the Texas A&M University GANLAB provided percent of dietary crude protein (CP), digestible organic matter (DOM), nitrogen and phosphorus. Technical assistance was provided to the rancher to assist in data interpretations and findings. Samples were taken on perennial range, native wet meadows, and irrigated pasture. Only the perennial/irrigated pastures had adequate information for analysis on a MLRA sub area. The short sample periods on 2 of the ranches added little information. Two locations on the perennial grasses provided the following information. During the grazing period April through November provided a maximum CP value in excess of 18 percent in May and a low of 10 to 10.5 percent in November. Average CP for these months was

13.79%. During the winter months cattle were fed hay while in a single pasture. Value for this period reflected a high of 10.86% with a low of 7.45%. The value varied by up to 2 percent during the winter month, which indicates varied hay quality. The samples on the perennial grasses reflected maximum value of 18.27% crude protein in May and a minimum of 8.86% in January. This is consistent with the findings on the irrigated pastures.

The DOM evaluation reflected a maximum of 67.49% in May and a minimum vale of 56.88% in December.

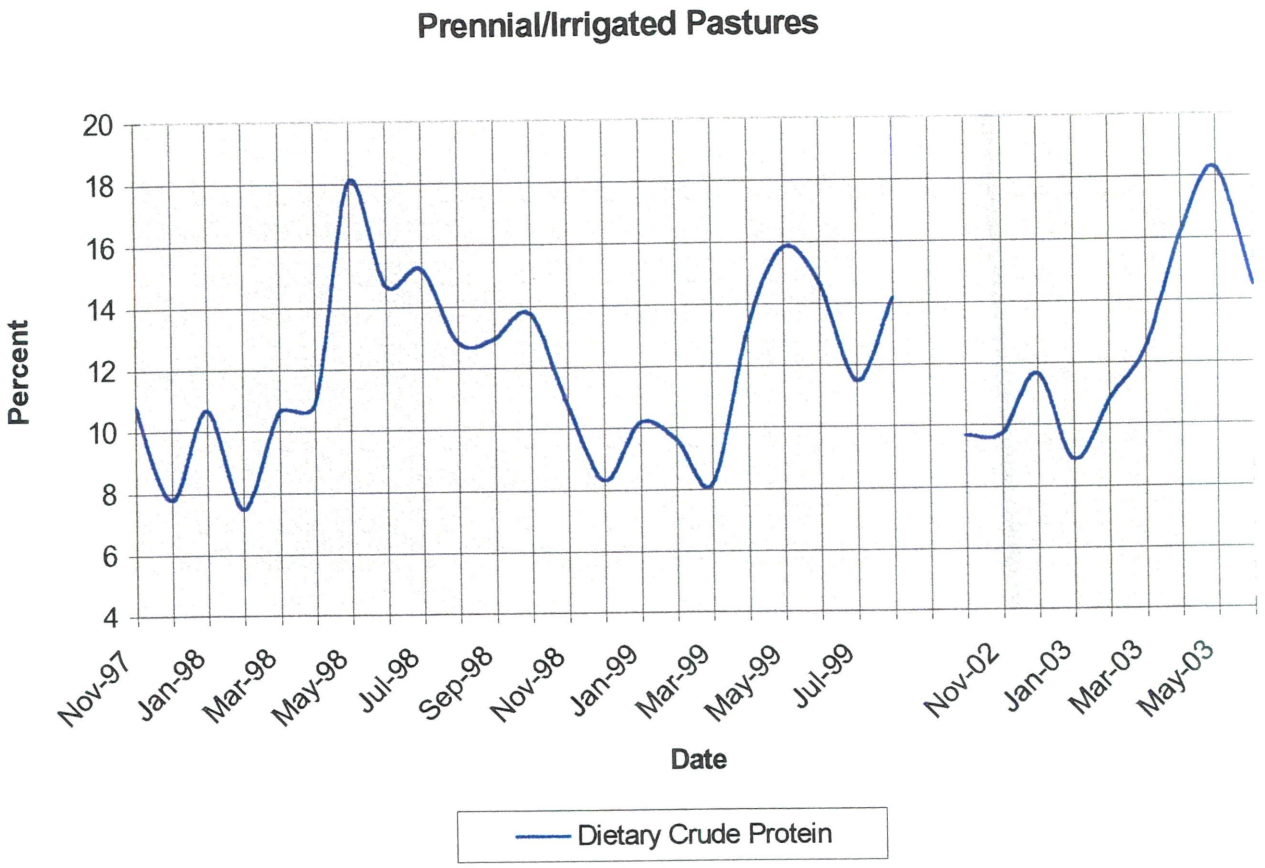
A case study was completed on a ranch operating in the MLRA. The NIRS method was used to determine the amount of crude protein and digestible organic matter. The Nutritional Balance Analyzer Program software program provided predicted weight gains on growing animals and body condition scores. Goal was to maintain a Body Condition Score (BCS) value of 5 throughout the breeding cycle. Hay was fed to cows and heifers during the winter months. Calving occurred from February through April. Results showed adequate nutrient requirements were met during all periods of the year. Rotational grazing kept animals on nutrient rich forage during the growing season. Quality of hay was enough to meet animal requirements during the last trimester of pregnancy. Supplements were not required.

The case study also evaluated bulls that were kept in a feedlot and were fed hay and mixed grain. Use of the NUTBAL program information resulted in the decrease in amount of grain being fed to the animals. Benefits were lower feed costs and improved animal performance.

Conclusions

- The NIRS fecal testing seems to accurately show the trends in diet quality. The CP and DOM levels on improved grasses with the rotational pasture management provided adequate energy needs for the period of April through November.
- Results from winter months reflected varying hay quality fed the animals. Values varied from 8% to 10.5% but were adequate to meet energy needs.
- NUTBAL can provide information to assist in determining feeding and supplement needs. The case study showed amounts of grain was reduced while maintaining animal's condition. Information provided resulted in decisions to decrease grain and benefited rancher by reduced overall feed costs.
- Managed native perennial meadows and improved grasses provide adequate CP and energy during the growing season. No supplements are required.
- This MLRA has little California annual grasslands but has many native perennial meadows and irrigated pastures.
- Case study and sample evaluation shows use of NUTBAL to be an effective tool for assisting ranchers in making management decisions

Figure C-13: Plot of Crude Protein and Digestible Organic Matter, MLRA 22A, for the period of November 1997 to May 2003.



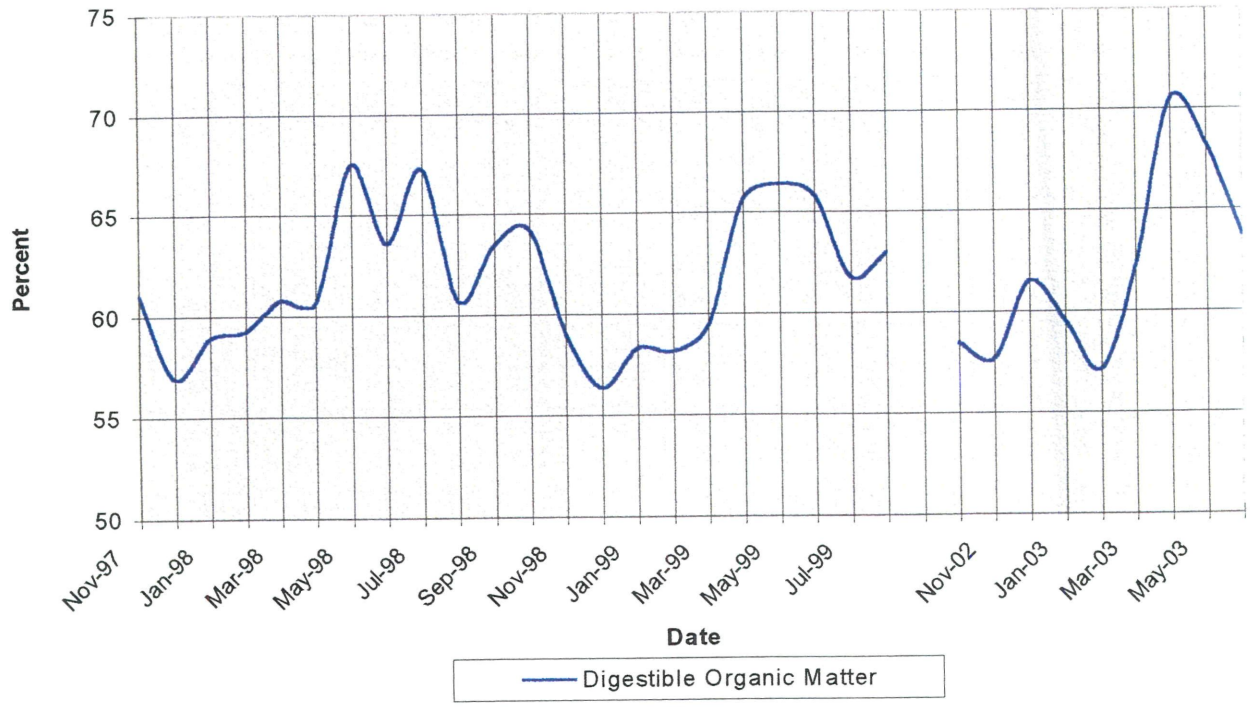
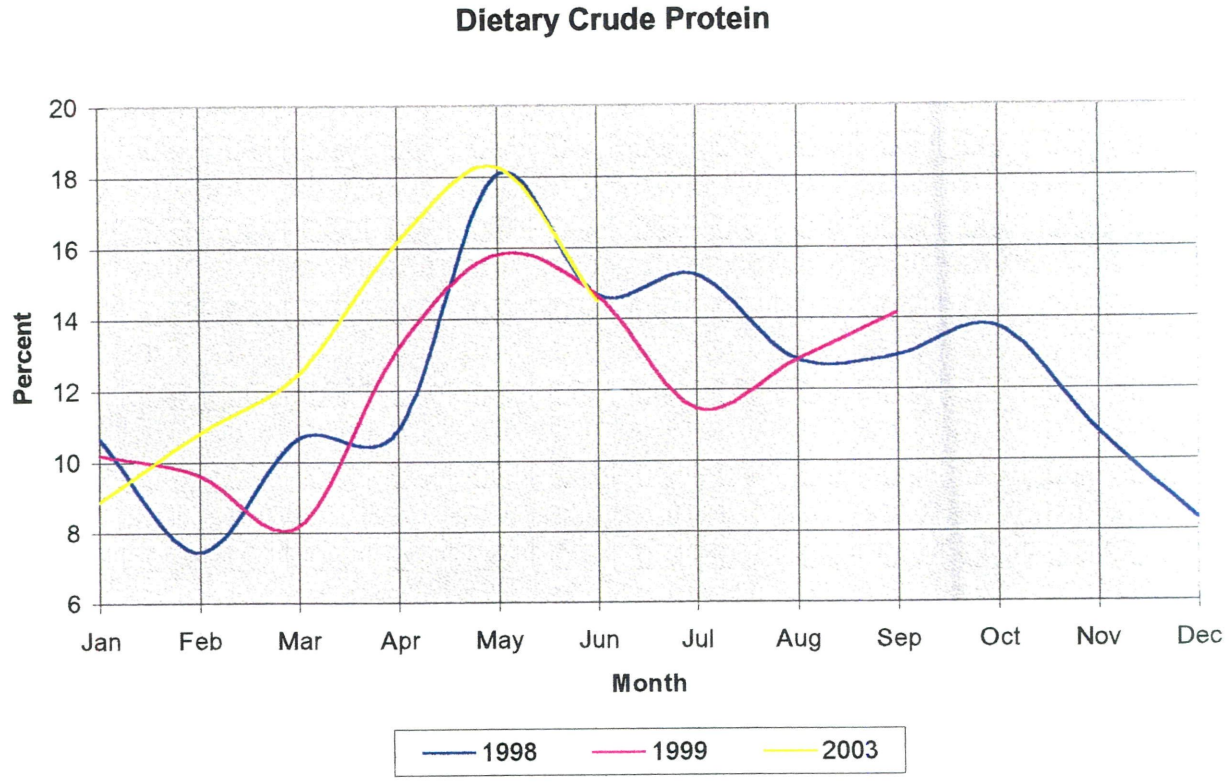
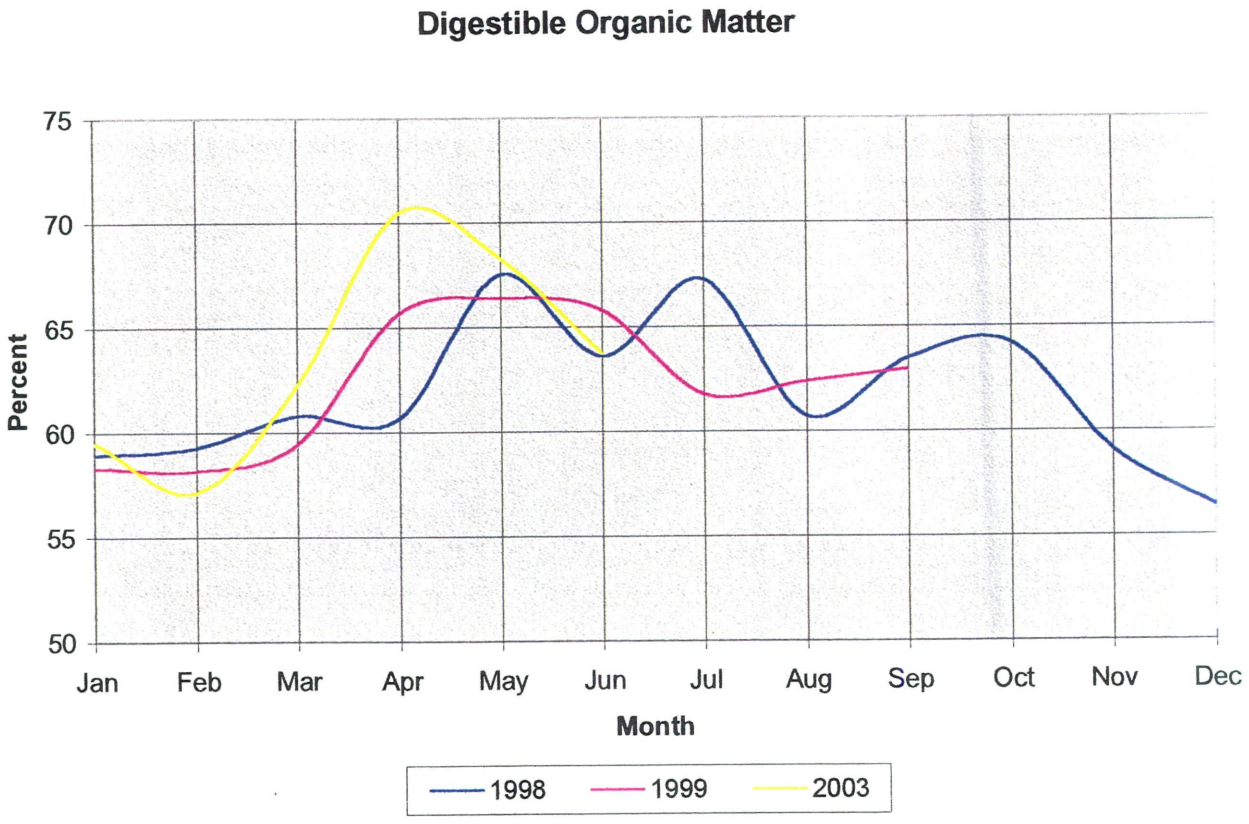


Figure C-14: Annual plot of Crude Protein and Digestible Organic Matter, MLRA 22A.





MLRA 23 - Malheur Plateau

MLRA 23 comprises the northern, particularly the northwestern, part of the Great Basin in the Basin and Range Province. The MLRA has few moderately slow rivers and streams in deeply incised canyons with bedrock controlled channels in the higher elevations to alluvial channels that terminate in basins or lakes in the Bonneville Basin section. The MLRA in California is composed of 5 sub units which is east of the Warner mountains and includes Surprise Valley, Sheldon Range, Honey Lake Basin, Madeline Plains, and Cottonwood - Skedaddle Mountains. Elevations vary from 4000 feet to 8,000 feet with precipitation ranges of 4 to 20 inches. Growing season is from 25 to 150 days. Refer to Table A for the predominant natural vegetation communities for the region.

The sample areas in which the NUTBAL software program was used were located in the Honey Lake Basin 23.CA5 sub unit. The sample sites are located in the valley section with the topography being gently sloping to level alluvial fans, floodplain, and basin floor. The elevation ranges from 3980 to 4300 feet on the alluvial lacustrine plain. Most of the sample area is flood irrigated with native and improved pasture species. On the ranch where sampling occurred, the rancher used rotational, intense, short duration grazing. Cattle graze on the pastures with primary meadow species being Fawn Tall fescue, Smooth Brome, alfalfa, Orchardgrass, Birsdfoot Trefoil, Meadow Barley, and saltgrass. The herds were grazed on the pastures from April through mid October. After the growing season cattle were moved to the winter range located in MLRA 17. Mean annual temperature is about 48 to 52 degrees Fahrenheit. The mean freeze-free period is from 100 to 150 days.

NRCS conducted evaluations at 4 locations over a 3-year period. Results using the NIRS analysis performed at the Texas A&M University GANLAB provided percent of dietary crude protein (CP), digestible organic matter (DOM), nitrogen and phosphorus. Technical assistance was provided to the rancher to assist in data interpretations and findings. Samples were taken on irrigated pasture, native perennial meadow that included grasses and sedges. Only the improved irrigated pastures had adequate information for analysis on a MLRA sub area however the spot data provides information on meadow values for energy during the growing season. The short sample periods on 2 of the ranches added little information. During the irrigated pasture grazing period, April through October, a maximum CP value 15.37 percent in July of 1999 was tested with a low of 7.61 percent in November. Average CP for these months was 11.05%. The limited native meadow values reflected a CP between 9.1% to 12.47%. The samples on the meadows dominated by sedges reflected maximum value of 6.96% crude protein to a minimum of 5.67%.

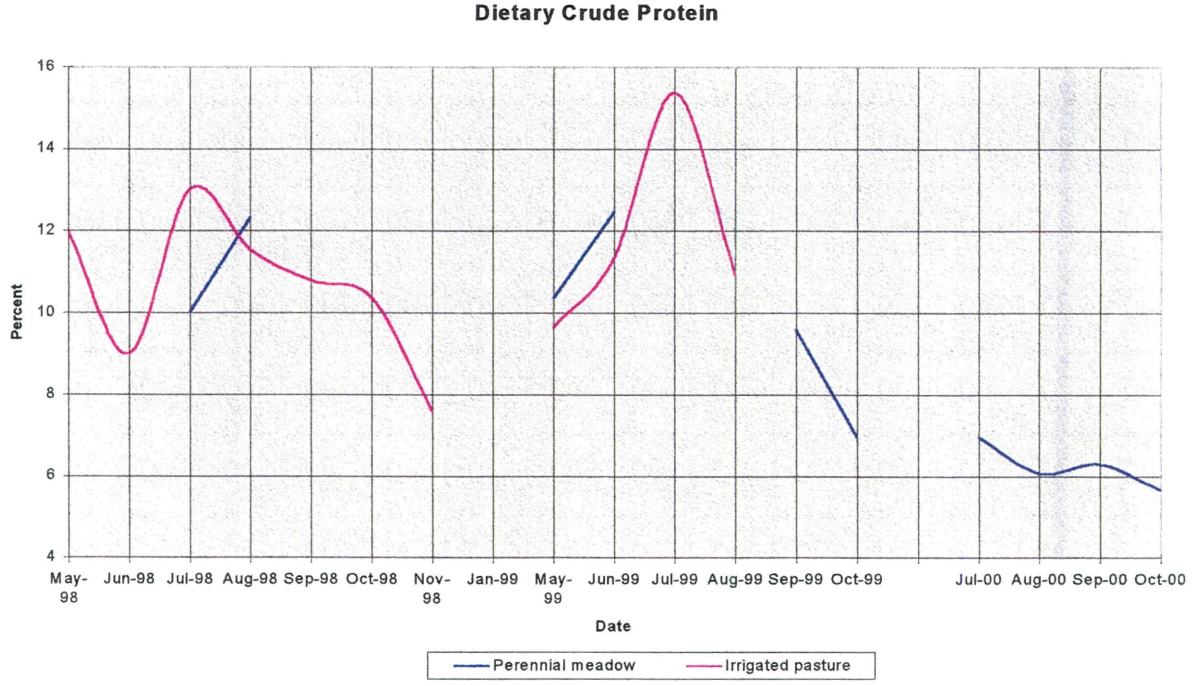
The DOM evaluation reflected a maximum of 62.75% in June 1999 and a minimum value of 58.85% in May for the irrigated grassland. The native vegetation reflected a maximum of 61.06% with a minimum of 57.95%. The DOM values for sedges were from 55.35% to 57.25%.

A case study was completed on a ranch operating in the MLRA. Near Infrared Reflectance Spectroscopy method was used to determine the amount of crude protein and digestible organic matter. The Nutritional Balance Analyzer Program predicted weight gains on growing animals and body condition scores. Goal was to maintain a Body Condition Score (BCS) value of 5 throughout the growing season. During the winter months animals were moved to annual grasslands in MLRA 17, where forage quality was high during the winter months. Calving occurred from February through April. Results showed adequate energy requirement was met during all periods of the year. Rotational grazing kept animals on nutrient rich forage during the growing season. Supplements were not required.

Conclusions

- The NIRS fecal testing seems to accurately show the trends in diet quality. The CP and DOM levels on improved grasses with the rotational pasture management provided adequate energy needs for the period of April through October.
- NUTBAL can provide needed information to assist in determining feeding and supplement needs.
- Managed native perennial rangeland and improved grasses provide adequate CP and energy during the growing season. No supplements are required.
- During winter months, animals are taken to the annual grassland of MLRA 17, where forage quality was adequate to meet animals needs from November to May.
- This management system, use of high elevation feed during the summer and annual grasslands in the winter provided the highest quality forages for breeding animals than another management scenario.
- Case study and sample evaluation shows use of NUTBAL to be an effective tool for assisting ranchers in making management decisions.

Figure C-15: Plot of Crude protein and Digestible Organic Matter, MLRA 23, for the period of May 1998 to October 2000.



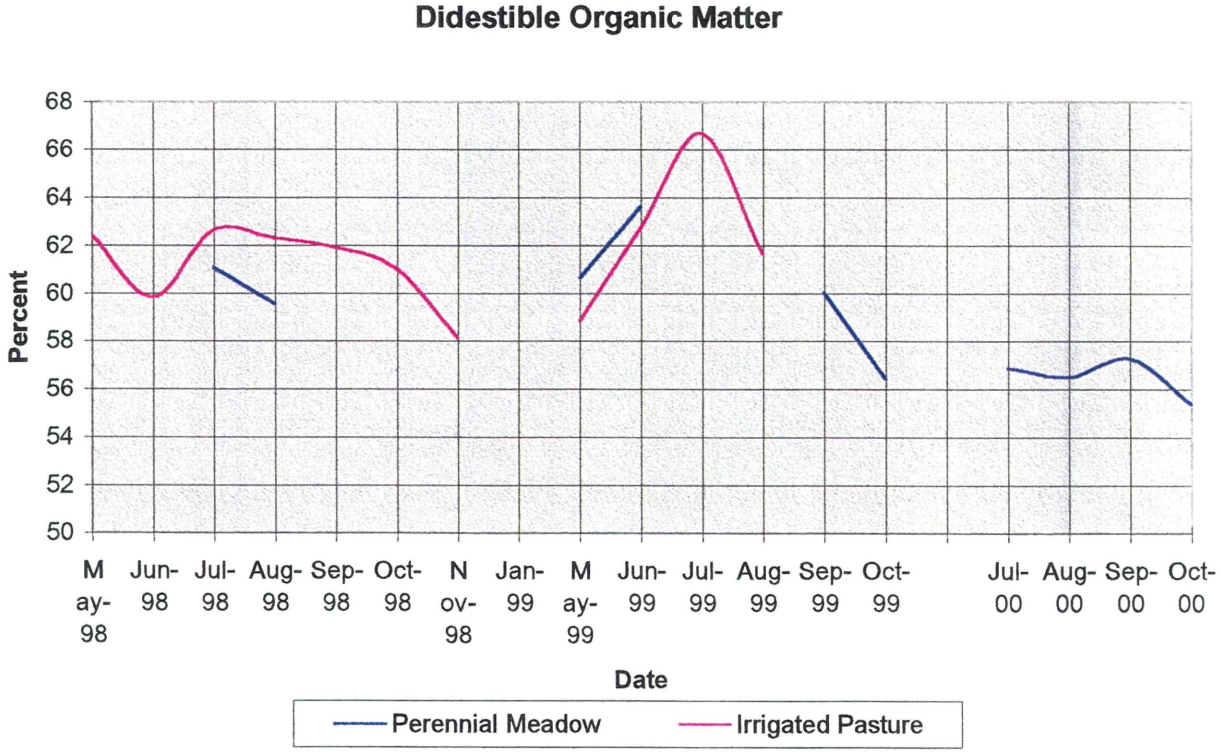
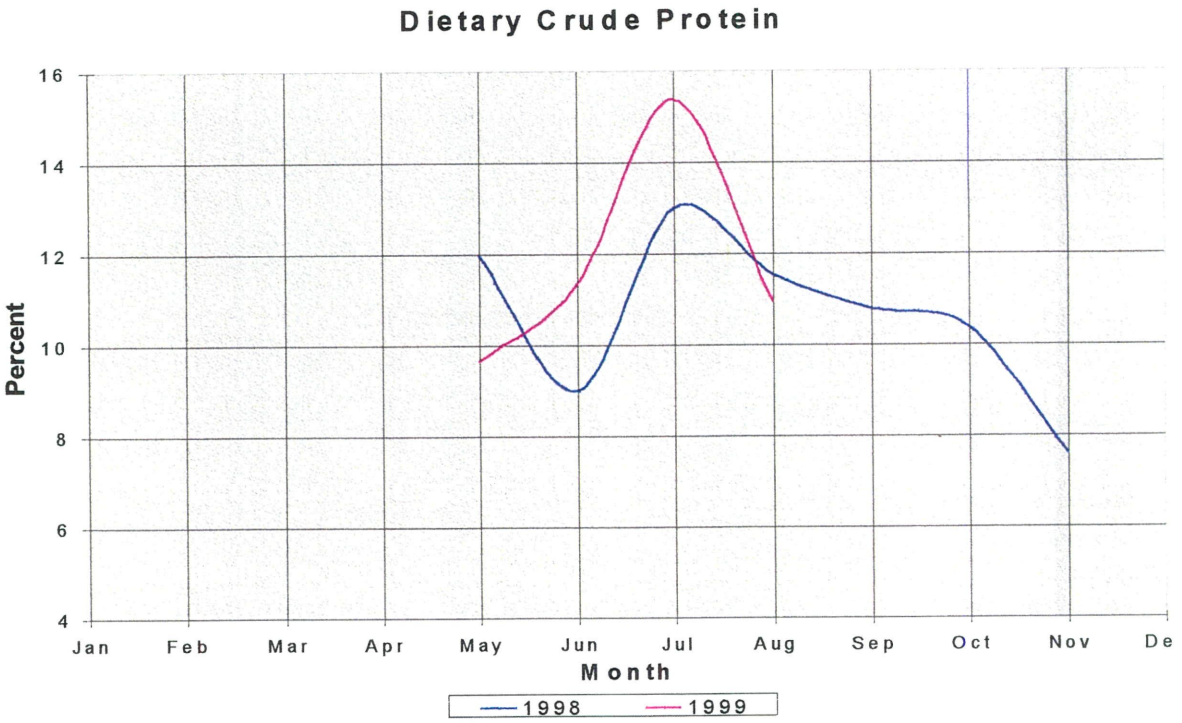
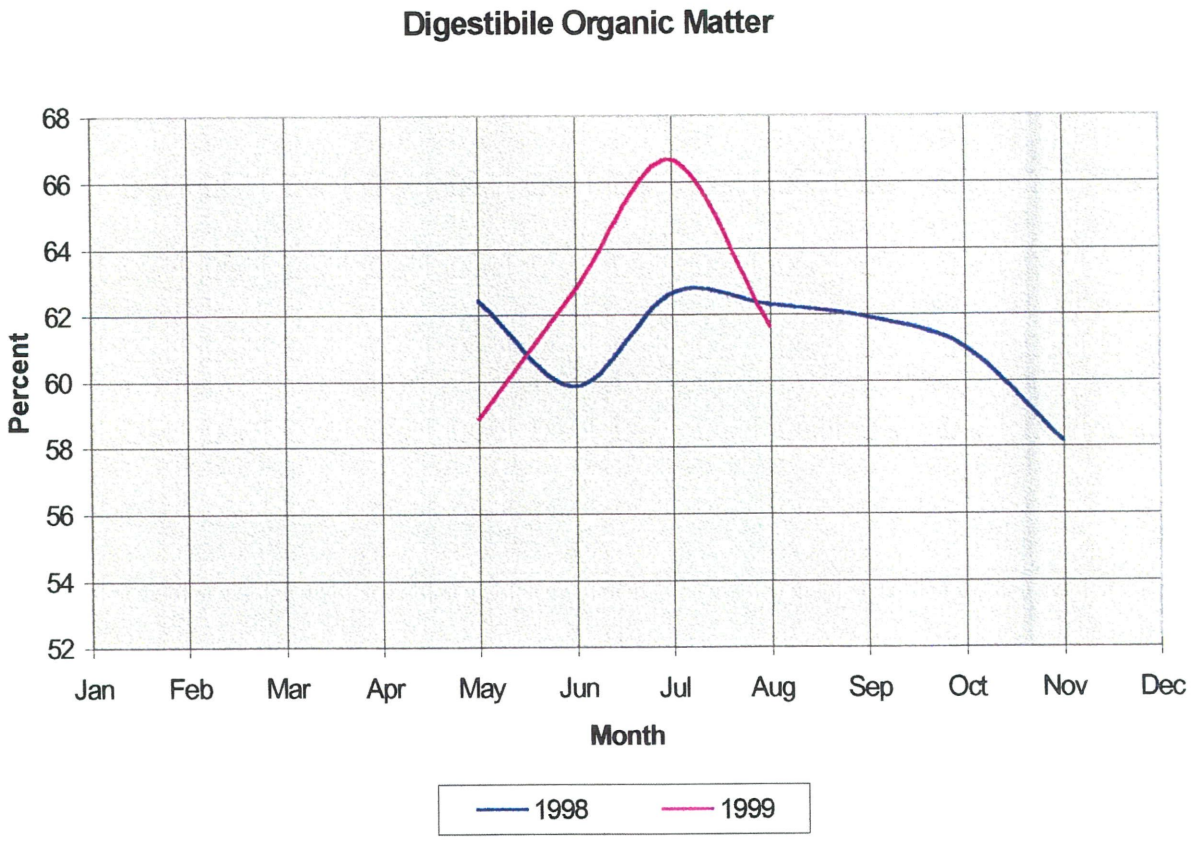


Figure C-16: Annual plot of Crude Protein and Digestible Organic Matter, MLRA 23.





MLRA 26 - Carson Basin and Mountains

MLRA 26 comprises the western part of the Great Basin just east of the Sierra Nevada Mountains. The MLRA has isolated ranges separated by aggraded desert plains with a few rapid flowing rivers and streams. Rivers and streams are incised canyons with bedrock controlled channels to alluvial channels that terminate in basins or lakes in the area. The MLRA in California is composed of 5 sub units. The subunits (26.CA1) Crowley Valley which include primarily of alluvial plains in Truckee Meadows, and Spanish Springs, Washoe, Carson and Diamond Valleys, (26.CA7) Sweetwater Mountains and Pine Grove Hills, (26.CA5) Mono Valley, (26.CA10) Bodie Hills-Exceisior Mountains, and (26.CA11) Carson Valley and Truckee Meadows. Elevations vary from 4400 feet to 14,200 feet with precipitation ranges of 5 to 30 inches. Growing season is from 20 to 200 days. Refer to Table A for predominant natural vegetation communities.

The sample areas in which the NUTBAL software program was used consisted of two ranches that were located in the northern region of the MLRA. The sample sites are located in the gently to moderately sloping alluvial fans and nearly level floodplain, terraces and basin floor. The elevation range is estimated to be from 4400 to 5000 feet. Sample areas include bluegrass/native meadows, native species communities, and irrigated pastures with native and improved pasture species. This MLRA has little California annual grasslands but has many meadow and irrigated valleys. The evaluations for crude protein and digestible organic matter were completed on two regimes. One included the native species and the other was on the introduced meadow species. The irrigated pasture had insufficient data but the data matched the evaluation completed in MLRA 23. Mean annual temperature is about 45 to 54 degrees Fahrenheit. The mean freeze-free period is from 100 to 125 days.

A third sample set was completed over a 3-year period on a flock of sheep, which used both MLRA 26 and MLRA 29. These findings are shown in a separate plot of CP and DOM. The vegetation for the sheep varied by time of year and location.

NRCS conducted evaluations at 2 locations on cattle over a1 1/2-year period. Results using the NIRS analysis performed at the Texas A&M University GANLAB provided percent of dietary crude protein (CP), digestible organic matter (DOM), nitrogen and phosphorus. Technical assistance was provided to the rancher to assist in data interpretations and findings. Samples were taken on irrigated pasture, native vegetation and meadows. Only the native vegetation and meadows provided adequate information for analysis on a MLRA sub area however the spot data provides information on irrigated pastures were compared to those of MLRA 23.

The crude protein (CP) results reflected a high value of 16.41% in the spring with a low of 10.89% in the fall for the native species. For the meadows a high of 15.21% in the spring while the low was 11.20% in the fall. The irrigated pasture

had only 3 months of values and therefore had inadequate information for evaluation. All tests reflected adequate CP values for the energy needs for the cattle from the native and meadow plant communities.

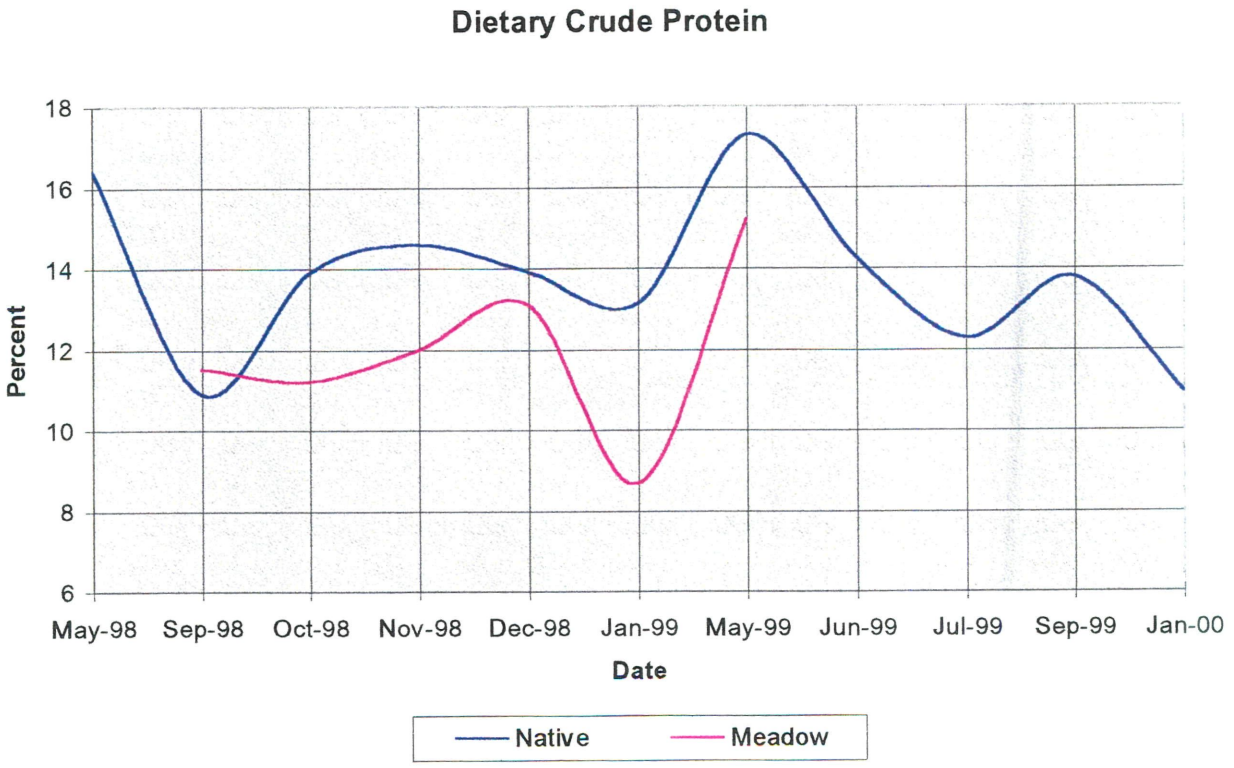
The DOM evaluation reflected a maximum of 68.16% in May 1998 and a minimum value of 60.17% in September for the native grass species. The meadow vegetation reflected a maximum of 65.12% with a minimum of 61.17%.

The evaluation and sampling on the sheep reflected crude protein values between 23.38% when on alfalfa to a low of 6.68% when on sedges. DOM varied from 73.91% to 57.19%.

Conclusions

- The NIRS fecal testing seems to accurately show the trends in diet quality. The CP and DOM levels on both the native and meadow grasses provided adequate energy needs for the period of April through November.
- Sample evaluation shows use of NUTBAL to be an effective tool for assisting ranchers in making management decisions.
- The evaluation on the sheep data clearly reflects the varying energy available to the animal is dependent upon the vegetation available. Alfalfa reflected CP values of 17 to 18% while sedge values were from 6.5 to 10%.
- A major portion of the MLRA region is in Nevada. Data collected should be compared to Nevada data and findings are developed from a combined set. Additional evaluations are required to develop recommendation for the MLRA.

Figure C-17: Annual plot of Crude Protein and Digestible Organic Matter, MLRA 26. Of native and meadow pastures from May 1998 to January 2000.



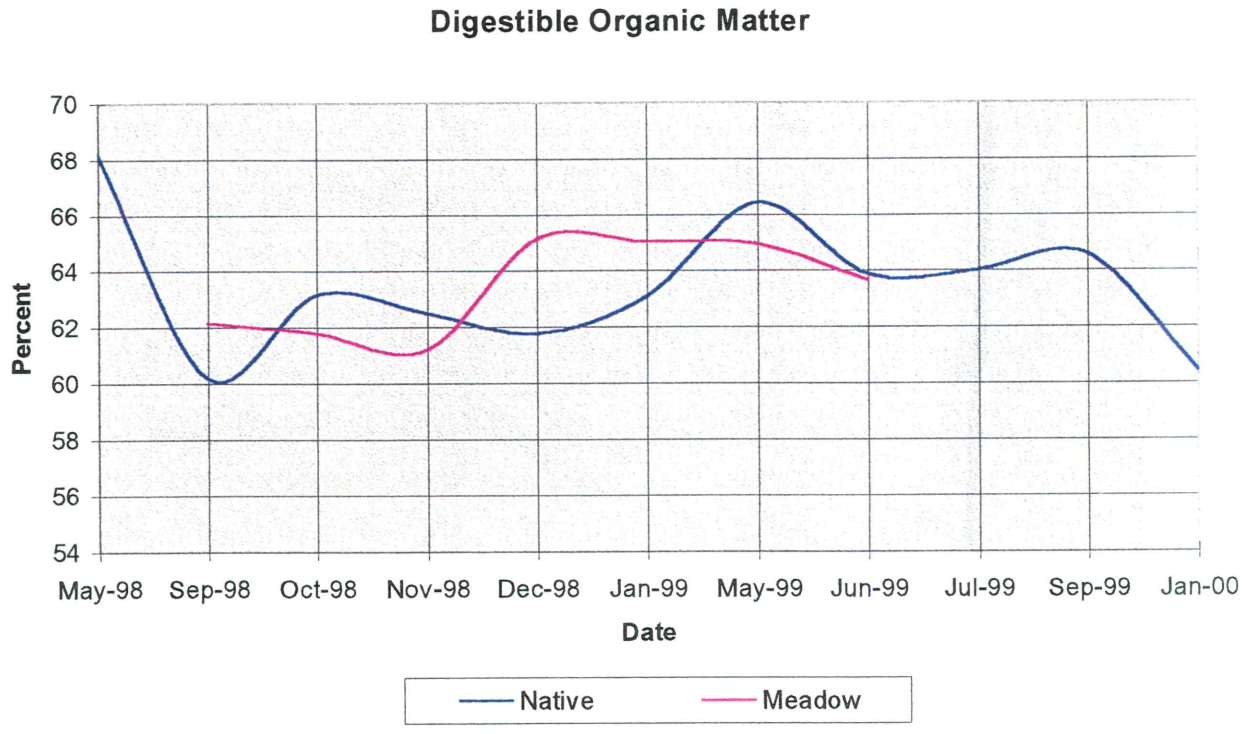
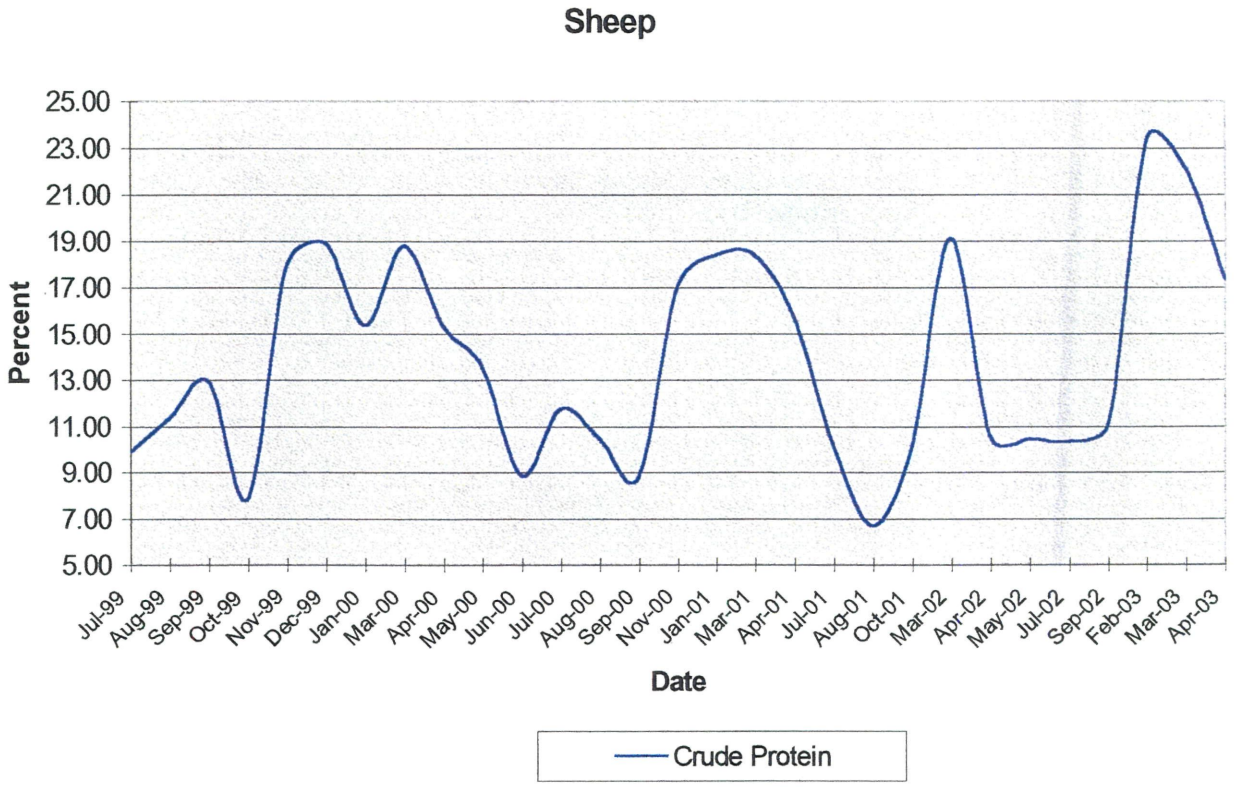
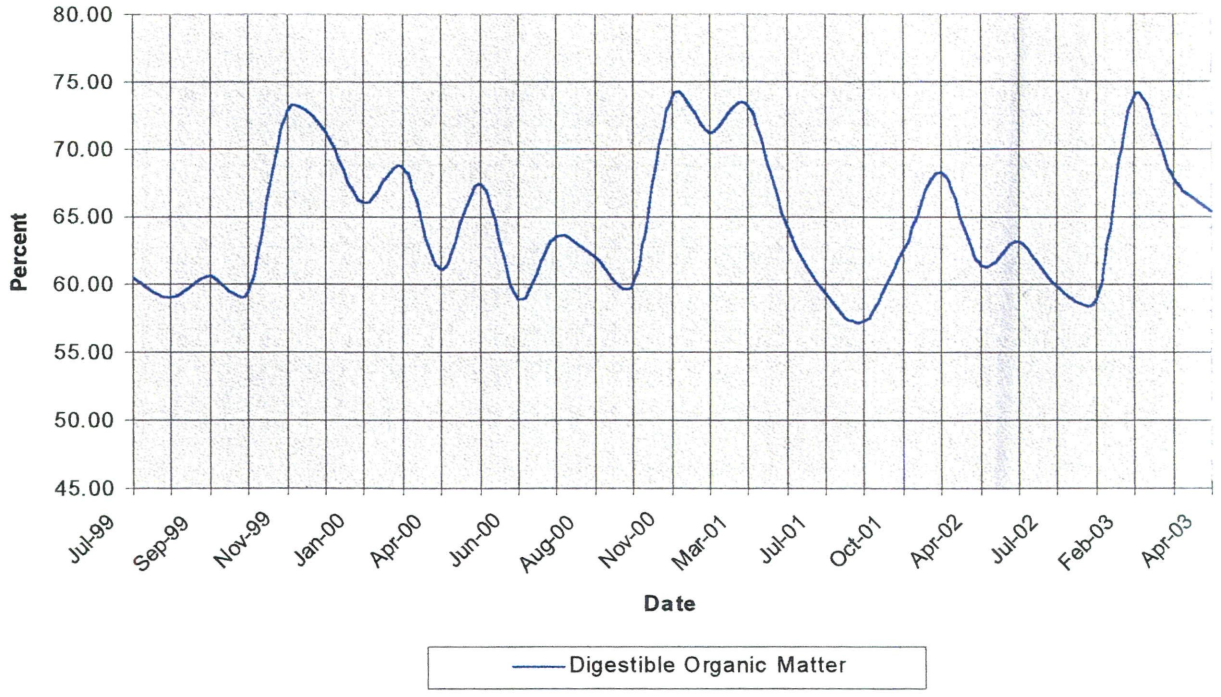


Figure C-18: Plot of Crude Protein and Digestible Organic Matter, flock of sheep in MLRA 26 and 29 for the period of June 2000 to April 2003.





MLRA 29 - Southern Nevada Basin and Range

MLRA 29 comprises the southern part of the Great Basin in the Basin and Range geomorphic province. The primary portion of the MLRA resides in Nevada with small portions existing in California. The MLRA has widely separated short ranges in desert plains. The California MLRA portion contains isolated mountains, plateaus, alluvial fans, playas, basin and dunes. The surface water characteristics are mostly bedrock-controlled channels in mountains that carry seasonal flows to alluvial channels below. Most channels terminate in basins with in the section. Elevations vary from 1000 feet to 11,000 feet with precipitation ranges of 4 to 20 inches. Growing season is from 100 to 275 days. Refer to Table A for the predominant natural vegetation communities in the region.

The sample areas in which the NUTBAL software program was used was one ranch located in the southwestern region of the MLRA. The sample sites included native species communities, sedge series, saltgrass and bunch grasses. The evaluations were for a 17-month period covering only 10 months of the period.

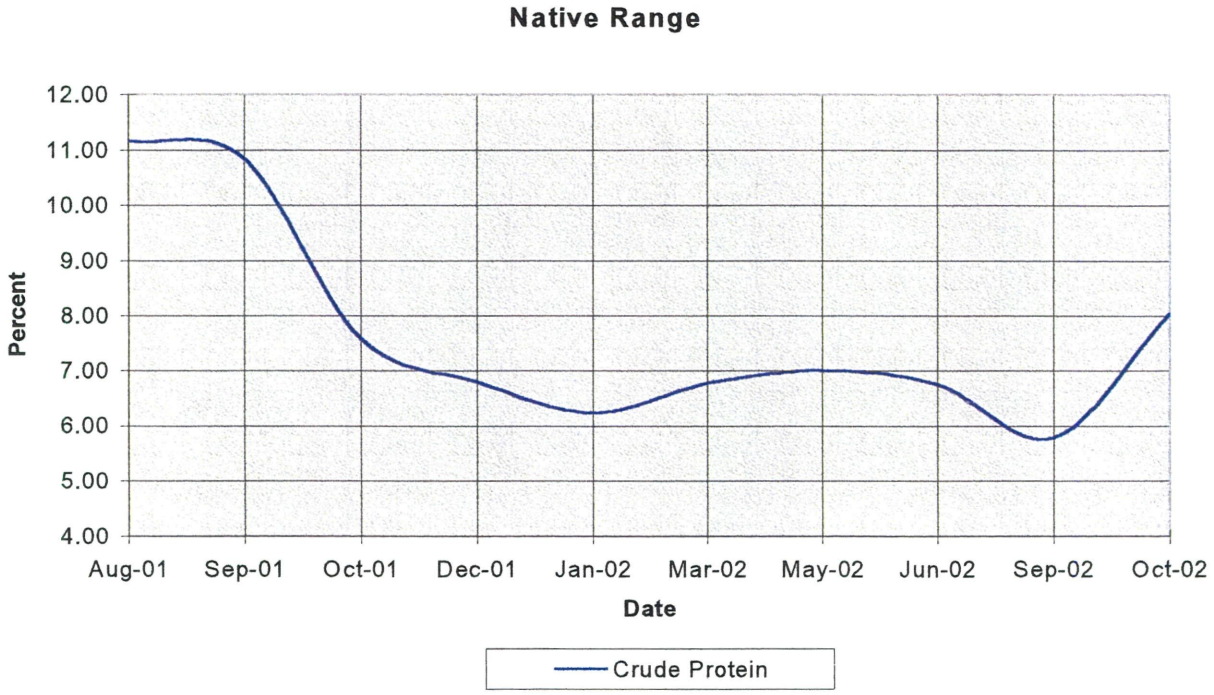
Results using the NIRS analysis performed at the Texas A&M University GANLAB provided percent of dietary crude protein (CP), digestible organic matter (DOM), nitrogen and phosphorus. Technical assistance was provided the rancher to assist in data interpretations and findings. The crude protein (CP) results reflected a high value of 11.16% in August with a low of 5.78% in September of 2002. The native species grazed reflected a CP value varying from 6.13 to 7.86% for the period of December through July. Tests reflected inadequate CP values for the energy needs for the cattle from the native and sedge plant communities.

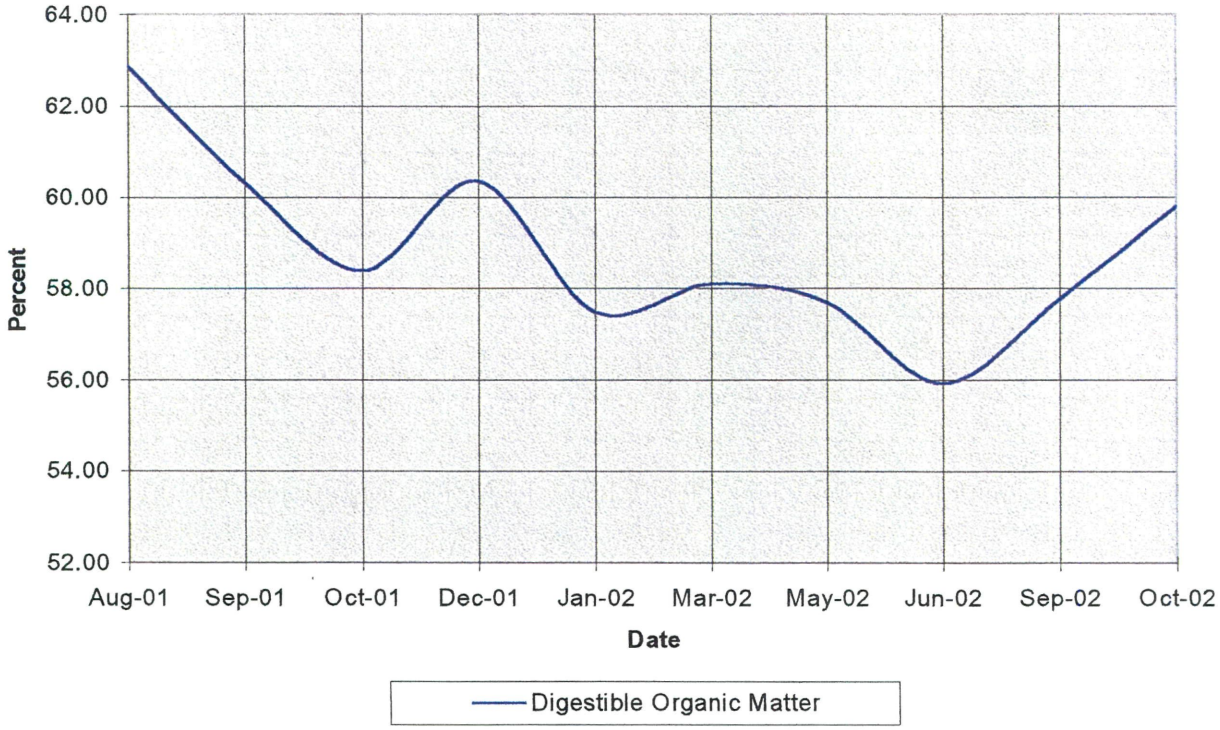
The DOM evaluation reflected a maximum of 60.34% in December 2001 and a minimum value of 57.48% in January 2002 for the native grass species.

Conclusions

- The NIRS fecal testing seems to accurately show the trends in diet quality. The CP and DOM levels. Tests indicate the sedges generally provide inadequate energy needs for the cattle and supplementation would be required to maintain animal condition.
- This MLRA has no California annual grasslands and covered a limited period therefore adds little information or assistance in this evaluation

Figure C-19: Plot of Crude Protein and Digestible Organic Matter, MLRA 29, For the period of April 2001 to October 2002.





MLRA 31 - Colorado Desert and Imperial Valley

MLRA 31 comprises the Colorado Desert and the Sonoran Desert. This evaluation will be on the Colorado Desert part because the sample sites are all located on the interface of it and MLRA 20. The Colorado Desert section is a very hot part of the basin and range province that is called the Salton Trough. The geomorphology consists of alluvial fans, basin, dunes and delta plains (Gulf of California). The surface water characteristics are mostly bedrock-controlled channels in mountains that carry seasonal flows though alluvial channels below to the Salton Sea. A few rivers that evolved from irrigation drainage water flow to the Salton Sea from Imperial and Coachella Valleys. Much of the MLRA has been converted to irrigated cropland. The western section is grazingland with limited water for irrigation. Refer to Table A for the predominant natural vegetation communities in the region.

The sample areas in which the NUTBAL software program was used was with 2 ranches located in the southwestern region of the MLRA. Ranched are located in the Corta Madera region of subsection M262Bo. The sample sites included native species communities, sedge series and meadows. Natural plant communities include Chamise series, Mixed Chaparral schrubland, and Live oak chaparral schrubland. Coast live oak series and Needlegrass are common in the valleys. Native grasslands include Foothill needlegrass series, Nodding needlegrass series, and Quillwort. The evaluations were for 2-year samples from native species, meadowlands, and sedges. These results can be compared to MLRA 20 as the ranches are located on the interface area of the MLRA and the characteristics closely resemble that resource. Rainfall in the sample area may vary from 6 to 20 inches depend upon yearly weather patterns. There are some reservoirs in the region.

Results using the NIRS analysis performed at the Texas A&M University GANLAB provided percent of dietary crude protein (CP), digestible organic matter (DOM), nitrogen and phosphorus. Technical assistance was provided the rancher to assist in data interpretations and findings. The evaluation was completed on 3 separate conditions being meadow, native, and sedges. The meadow included 9 samples from June 2001 through March 2002. There are 10 samples of native vegetation from May 2002 to April 2003 and 9 samples on sedges from January 2001 to August 2002.

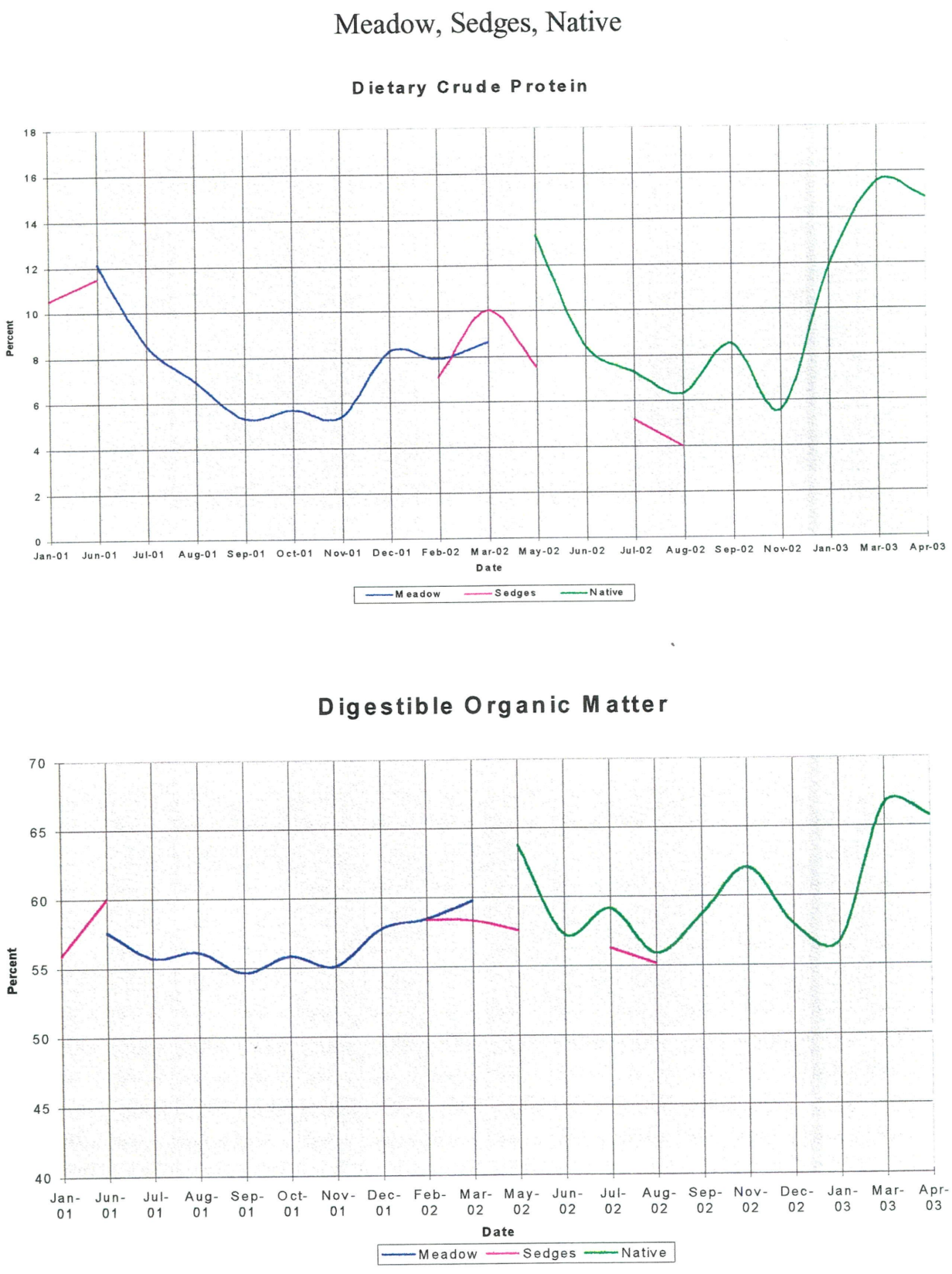
For the meadow samples crude protein (CP) results reflected a high value of 12.126% in June with a low of 5.37% in September of 2001. The native species grazed reflected a CP value varying from a high of 15.54% in March 2003 to a low of 5.57% in November 2002. The sedge sample had a high of 11.46 in June 2001 with a low of 3.98 in August 2002.

DOM value for meadowland had a high of 59.76 in March 2002 and a low of 54.64 in September 2001. Values for the native samples were a high of 66.61 in March 2003 with a low of 55.91 in August 2002. The sedges had a high of 60.03 in June 2001 with a low of 55.13 in both October 2001 and August 2002.

Conclusions

- The NIRS fecal testing seems to accurately show the trends in diet quality. The CP and DOM levels.
- Tests indicate the cattle must be managed to assure that they are in the correct pastures during periods of high CP value. For meadowland period exceed 8% from March to July, native periods are from January through June and for sedges it is limited to January through March.
- To provide adequate energy for maintaining the cattle addition feed or supplementation will be required or moved to other pastures for the summer and fall periods.
- NUTBAL can provide needed information to assist in determining feeding and supplement needs.
- Sample set seems to better fit the characteristics of MLRA 20 therefore additional information is needed in this MLRA.

Figure C-20: Plot of Crude Protein and Digestible Organic Matter, MLRA 31, for the period of January 2001 to August 2003.



General Characteristics[1,2]

	MLRA-4B	MLRA-5	MLRA-15	MLRA-17	MLRA-18	MLRA-20
Area (square miles)	5360	13790	8460	19140	2820	9500
States	CA	CA, OR	CA	CA	CA	CA
LAND USE						
Private	90%	50%	80%	90%	80%	60%
Federal and state	10%	50%	20%	8%	20%	40%
Forest land	68%	Most	35%	Minor	20%	40%
Grazingland	10%	10%	50%	33%	75%	20%
Cultivated	3%	Valleys	10%	50%	5%	Valleys
Elevation (feet)	0 to 3000	200 to 9000	100 to 5200	0 to 2000	200 TO 2000	300 to 11500
Precipitation (inches)	20 to 120	18 to 120	6 to 40	5 to 25	8 TO 40	6 to 40
Temperature (F) (mean annual degrees)	40 to 60	30 to 57	35 to 65	56 to 62	45 TO 64	40 to 70
Growing Season (days)	250 to 300	25 to 225	85 to 275	250 - 300	150 TO 300	150 to 300
Soils						
Alfisol	X	X	X	X	X	X
Airidsols			X		X	X
Entisols		X	X		X	X
Histisols						
Inceptisols	X	X	X	X	X	X
Mollisols	X	X	X	X	X	X
Oxisols						
Spodosols	X					
Ultisols	X	X				
Verisols	X		X	X	X	
Temperature regime						
Isomesic	X					
Mesic	X	X	X			X
Thermic	X	X	X	X	X	X
Frigid or Cryic		X	X			X
Natural Vegetation Series						
Douglas-fir	X	X	X		X	X
Grand-fir	X		X			
Red fir		X				
Blue oak			X	X	X	
Valley oak			X	X	X	
Canyon live oak		X	X			X
Sugar pine		X				X
Digger pine					X	
White-fir		X				
Bishop pine	X					
Jeffrey pine						X

[1] Land Resource Regions and Major Land Resource Areas of the United States, Soil Conservation Service, Agricultural Handbook 296

[2] Ecological Subregions of California, US Forest Service, Pacific Southwest Region, RE-EM-TP-005

TABLE A

General Characteristics (cont.)

	MLRA-4B	MLRA-5	MLRA-15	MLRA-17	MLRA-18	MLRA-20
Chinkapin	X					
Madrone	X	X	X			
Ponderosa pine		X	X			X
Incense-cedar		X				X
Redwoods	X		X			
Tanoak	X	X	X			X
California Black oak	X	X	X	X	X	
Willows and Cottonwoods				X		
Buckwheat						
Big sagebrush						X
Sage brush			X	X		
Coyotebrush and/or rabbitbrush	X		X	X		
Chamise			X	X	X	X
Manzanita		X	X		X	X
Scrub oak			X		X	X
Snowberry		X	X			
Ceanothus and/or bitterbrush		X	X		X	X
Wipplea		X				
Juniper						X
Perennials grasses						
California oatgrass	X		X			
Western and Idaho fescues	X	X				
Pacific reedgrasses	X					
Bluegrass	X	X	X		X	X
Wildrye		X		X	X	X
Needlegrasses	X		X	X		X
Buckwheat						X
Sedges	X	X	X	X		X
Wiregrass						X
Wheat grass						
Tufted Hairgrass	X	X			X	
Annual grasses						
Annual Ryegrass						
Cheat grass	X	X	X	X	X	X
Soft chess	X	X	X	X	X	X
Wild oats	X	X	X	X	X	X
Bromes	X	X	X	X	X	X
Fescues		X	X	X	X	X
Filaree	X		X	X	X	X
Burclover	X		X	X	X	X
Wild barley			X	X		
Introduced Perennials						
Harding grass/Pertagrass	X			X		
Orchard grass				X		
Fescus (Tall)				X		
Timothy				X		
Garrison Creeping Foxtail				X		
Clovers/Trefoil						

TABLE A

General Characteristics (cont.)

	MLRA-21	MLRA-22	MLRA-23	MLRA-26	MLRA-29	MLRA-31
Area (square miles)	13650	25170	28210	9250	25630	3640
States	CA, OR	CA, NV	CA,NV,OR	CA, NV	CA,NV,UT	CA
LAND USE						
Private	50%	50%	25%	25%	Small%	90%
Federal and state	50%	50%	75%	75%	90%	Small%
Forest land	Small	90%	Small	10%	Small%	0
Grazingland	85%	8%	95%	85%	Majority	Desert
Cultivated	8%	1%	2%	2%	1%	Large%
Elevation (feet)	3000 to 9900	1000 to 14495	4000 to 8000	4400 TO 14200	1000 to 11000	(-)230 to 2200
Precipitation (inches)	8 to 30	10 to 90	4 to 20	5 TO 30	4 to 20	3 to 6
Temperature (F) (mean annual degrees)	35 to 52	25 to 60	30 to 52	30 to 58	35 to 72	68 to 75
Growing Season (days)	25 to 150	10 to 200	25 to 150	20 TO 200	100 to 275	280 to 350
Soils						
Alfisol	X	X		X		
Airidsols	X	X	X	X	X	X
Entisols	X	X	X	X	X	X
Histisols	X					
Inceptisols	X	X	X	X	X	
Mollisols	X	X	X	X	X	
Oxisols						
Spodosols						
Ultisols		X				
Verisols	X			X		
Temperature regime						
Isomesic						
Mesic	X	X	X	X	X	
Thermic					X	hyper X
Frigid or Cryic	X	X	X	X	X	
Natural Vegetation Series						Desert Veg
Douglas-fir	X	X				
Grand-fir			X			
Red fir	X	X		X		
Blue oak						
Valley oak						
Canyon live oak		X				
Sugar pine		X				
Digger pine						
White-fir	X	X		X		
Bishop pine		X				
Jeffrey pine	X	X		X		
Western redcedar						

TABLE A

General Characteristics (cont.)

	MLRA-21	MLRA-22	MLRA-23	MLRA-26	MLRA-29	MLRA-31
Chinkapin						
Madrone						
Ponderosa pine	X	X				
Incense-cedar		X				
Redwoods						
Tanoak		X				
California Black oak		X				
Willows and Cottonwoods	X	X	X	X		
Buckwheat						
Big sagebrush	X		X	X	X	
Sage brush	X	X	X	X	X	
Coyotebrush and/or rabbitbrush	X		X	X		
Chamise						
Manzanita				X		
Scrub oak						
Snowberry					X	
Ceanothus and/or bitterbrush	X					
Wipplea			X			
Juniper	X	X	X	X	X	
Perennials grasses						
California oatgrass						
Western and Idaho fescues	X	X				
Pacific reedgrasses						
Bluegrass	X	X	X	X	X	
Wildrye	X		X	X		
Needlegrasses	X	X	X	X	X	X
Buckwheat						
Sedges	X	X	X	X	X	X
Wiregrass	X	X	X	X	X	X
Wheat grass	X	X	X	X		
Tufted Hairgrass						
Annual grasses						
Annual Ryegrass						
Cheat grass	X	X	X	X		
Soft chess						
Wild oats						Scattered
Bromes		X				
Fescues		X			X	
Filaree						
Burclover						
Wild barley						
Introduced Perennials						
Harding grass/Pertagrass						
Orchard grass	X	X	X			
Fescus (Tall)	X	X	X			
Timothy						
Garrison Creeping Foxtail						
Clovers/Trefoil		X	X			