Pasture land management system decision support software

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Introduction Controlled or rotational grazing provides benefits to producers and society through profitable and sound management of grazing land and livestock. Pasture land management system (PLMS) is a decision support system developed to help university, government, and professionals provide technical pasture management assistance to beef and dairy producers. The PLMS focuses on the balance between seasonal forage supply and nutrient demand in a dairy or beef cattle operation. It allows users to explore and compare alternatives (dividing fields into multiple paddocks, changing stocking rates, and forage species) through a visual display and embedded simulation. Users enter a description of the farm by drawing a map. Maps can be drawn freehand, traced over a scanned image, or GIS data may be incorporated. Once map and field data are entered the grazing options are specified via input screens. Grazing systems can be easily compared without economic risk and with almost immediate feedback on how these alternative systems affect variables like milk production and pounds of beef sold. PLMS serves as both an educational tool and a strategic planning tool for evaluating alternative grazing operations and management related investments (website: http://clic.cses.vt.edu/PLMS/).

Materials and methods The PLMS has been developed using standard software engineering practices with active participation by users in the design and iterative development of the prototype system. The program incorporates GIS components using MapObjects™, which gives it the ability to display spatially referenced data stored as shape-files. The PLMS was written in Java using Microsoft's Visual J++™, both to enhance cross-platform development (a possible web version) and to simplify the integration of visual and model components. The design goals of PLMS are to: 1) increase adoption of management intensive grazing, 2) aid users in exploring alternative grazing management options, 3) allow graphical display of animal demands and farm forage supply to support an iterative process to evaluate alternatives, 4) simulate a representative 365-days with up to half-day rotations, 5) provide rule-based animal movements between pasture (see next section), 6) harvest surplus forage as hay, 7) feed hay during deficits (raised or purchased) and 8) provide supplements to dairy cattle.

The following rules are used for each simulation: 1) Animals enter pastures at 1,794 kg/ha and exit at 897 kg/ha of DM, 2) The entry threshold is reduced by up to 25% for a field growing maximally, 3) Exit thresholds are reduced when paddock growth rate declines as much 50%, 4) Hay is harvested when total DM in a field exceeds 3,587 kg/ha and 673 kg of DM per hectare is left as residue, 5) Hay is also harvested when forages in a field have stopped growing and more than 1,794 kg/ha of DM (half the hay harvest trigger of 3,587 kg/ha) remain.

Results Users receive immediate visual feedback using a pair wise comparison of any 2 alternatives (Figure 1). Results are depicted via line graphs (Figure 1) of animal demand, forage supply, hay fed, and via bar charts for major factors, e.g. total tons of hay. In addition to the visual output each simulation produces a detailed output file (all output variables over the 365-days simulated) that can be viewed in an Excel® spreadsheet. The output file is used to fine tune the final management plans and/or for checking errors.

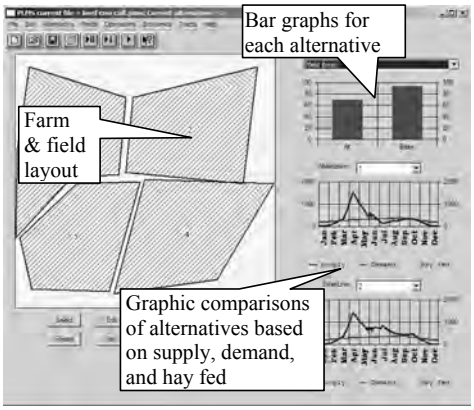

Figure 1 PLMS main screen and output

Conclusions The program was released in 2001 and has been used by extension, government, and other personnel to design grazing systems in the U.S. Mid-Atlantic region. End users have provided constructive criticism that is being incorporated into the model, resulting in 3 major revisions since 2001. It should not be evaluated as a planning tool for its ability to accurately reproduce field data collected in specific grazing trials. Rather, its value is in its ability to make reasonable and accurate comparisons between alternative grazing management plans.