Developing a Site-Specific Management Program: Part 1

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Bottom line: Incorporating weather data and tested agronomic principles into your yearly management planning process can help you to avoid many stress and pest related challenges to turf, and can keep you better prepared to deal with those unpredictable problems that always do seem to occur. Turf growth potential values, which are based on air temperatures at your site, are the foundation for predicting periods of turf stress, and therefore those times when extra care needs to be taken in the form of scheduling appropriate nutrition, pest management and cultural practices.

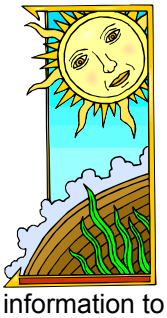
Weather is by far the single most powerful factor controlling turf quality. From turf growth, to damage caused by insects, diseases and weeds, to the success or failure of overseeding – all of these are controlled primarily by weather. Weather that is unpredictable, capricious and frequently unkind to turf managers. Yet despite the unknowability and power of weather, it is possible to be proactive and thus avoid many of the challenges that Mother Nature hurls at you, and at the turf, each year.

Using weather forecasting to predict turf stress. Predictions of extreme heat (air temperatures greater than 115F) led to the use of fans on the bentgrass green shown in the top photo. Where no fans were used on the same golf course on the same date (photo below), turf suffered extreme heat stress.

One important proactive step you already take is to closely monitor weather conditions, and to adjust your management programs accordingly. In 2002, we introduced the use of site-specific, weekly weather forecasts in combination with PACE turf growth models to help you make more accurate management decisions related to water use, nitrogen use, and overall turf growth. This information appears in the FAXed Updates that you receive weekly from March through November, and has provided week-by-week guidelines that are based on the ever-changing weather patterns at your location.

During 2003, we want to continue to expand the use of climate and weather data in your yearly management planning process. With the next few issues of *PACE Insights,* we will help you build a science-based, comprehensive, year-long turf management program that incorporates the past 30 years of weather data into your planning process. By looking closely at your historical weather patterns, we can try to predict when turf will be most stressed (due to excessive heat or cold, low light intensity, periods of drought, flooding etc.), when pest populations are about to explode, when the turf needs additional nutrition or when preventive cultural practices or pest control measures will be most helpful. Your completed management plan can be used throughout the year as both a planning tool -- for scheduling, purchasing, budgeting and coordinating -- and also as a communication tool that can help you explain to your crew, to your management, golfers and others the scientific basis for management decisions and turf performance.

Weather vs. climate: a conundrum



We have just two important definitions to review before we get started.

The planning process that we discuss in the next few issues of *PACE Insights* will be heavily based on **climate** data for your location. In other words, we will be looking at the historical weather record for general trends in the weather at your site, and we will use this information to make predictions about future weather trends. We are fortunate to have access to the 30 year normals (daily temperature and precipitation data averaged from 1971-2000) for many U.S. locations. Having 10,950 days of data from each location is a powerful tool that allows us to predict general trends with as much certainty as possible.

That said, there is always the **weather** to contend with. If climate represents past trends in temperature,

precipitation, wind and humidity at your location, then weather represents the present. Weather is the state of the atmosphere at a given time (now!), and can vary dramatically and somewhat unpredictably from day to day, week to week and year to year.

Our conundrum is this: we want to use site-specific climate data – that is, the history of your weather trends – to help predict the future impact of weather at your course. But we have just defined the weather as being unpredictable by nature. So can we really predict and plan for the future based on climactic data from the past? The answer is "yes", but with some caveats – some precautions or reservations that must be kept in mind. Using the red flag symbol to the right, we will bring these caveats to your attention in the discussions below.

The Climate Appraisal Form

The enclosed **Climate Appraisal Form** was developed based on 30 years of data (the "30 year normals") from a weather station that is as close as possible to your golf course. The information in this form will be used to build your site-specific management program.

Caveats: In some cases, the closest weather station that we have access to may be up to 10 miles from your location. Furthermore, the weather of the past 30 years can only help to roughly guess what to expect in the coming year. While this data is an exceptionally detailed record of average or normal weather trends over the past 30 years, it always seems as if the year we are currently living in is the weirdest, most abnormal year in history. For these reasons, the Climate Appraisals and Management Programs we develop together should be used only as rough guidelines for planning the future. Your experience and real time, on-the-spot observations are the fine-tuning tools that will keep your program as accurate and useful as possible.

The Climate Appraisal includes the following data:

Normal average temperature: the average monthly air temperature at your site, based on the past 30 years of air temperature data

Normal precipitation: the average monthly precipitation (rain and snow), based on the past 30 years of precipitation data

Turf growth potential: we have calculated the growth potential for cool season turf ("cool season GP") and warm season turf ("warm season GP"). Explained in greater detail in *PACE Insights* (March, 2000), the turf growth potential values are estimates of the relative growth of cool or warm season turf based on air temperatures. Values range from 0 – 100%, and the higher the value, the greater the turf growth. When air temperatures are either too high or too low for optimal growth, the growth potential will decrease. **When growth potential values are less than 50%, the turf is considered to be under stress.** We have highlighted those stress periods in yellow on your appraisal form.

Maximum nitrogen requirements: Maximum monthly nitrogen requirements have been calculated based on the projected growth potential of cool or warm season turf. When making these calculations, we assume that the maximum amount of nitrogen that should be applied per month is 1 lb/1000 sq ft.

Getting ready

For this stage of the planning process, you will need the following tools:

- **Climate Appraisal** form
- A blank **Management Plan**
- An **erasable highlighter**: There is a marker at each end of the enclosed highlighter. The white marker can be used erase any errors you make with the yellow marker, but we have found that you can only erase a given area once! The yellow marker will not work on any area that has been previously erased. So take some care before using the highlighter. If you need extra blank management plans, you can either call us for more, or you can find them on our website (www.pace-ptri.com) under "Events", where they are available for printing, ideally onto 11X17 paper.
- **Sample Management Plan**. On the sample management plan, we have selected a hypothetical location in Riverside, CA to demonstrate the various steps in the process. Refer to this periodically for an illustrated version of the process that we will describe below.
- **Pencil and eraser**

We're going to walk through this process with you with a focus on golf course greens, but we strongly suggest that you repeat the process for fairways, tees and roughs as well.

Mapping turf stress vs. cultural practices

Understanding when turfgrass is likely to be stressed – as the result of heat, cold, excessive rainfall or drought, high soil salts, tournaments, etc. can help you better schedule your management practices. For example, potentially stressful management practices (aerification, herbicide applications, etc) can be avoided during periods of decreased turf growth and stress, and practices geared towards encouraging turf growth can be substituted.

On your Management Plan:

1. Use the yellow highlighter to indicate periods of turf stress for cool season turf and warm season turf. These periods are highlighted in yellow on your **Climate Appraisal** form. If you are managing only

cool season turf on your greens, then you can ignore the warm season turf data (and vice versa)

2. High rainfall and/or overcast conditions can produce turf stress due to disease and/or lack of sufficient solar radiation. If there are months where persistently overcast, cloudy or rainy weather (more than 5 inches per month) results in stress to your turf, highlight them in yellow on the warm season or cool season turf stress line (if they aren't already highlighted due to sub-optimal air temperatures).
3. Using a pencil, mark a "T" to indicate tournament dates on either the cool or warm season stress lines.
4. Using a pencil, mark an "X" to schedule the following cultural practices. Remember to avoid aggressive cultural practices (aeration, heavy topdressing vertical mowing) during the highlighted periods of stress/slow growth:
   - Tree maintenance: trimming, lacing and/or removal should be scheduled during months of low light intensity (typically, fall/winter) to increase solar radiation in areas that are stressed due to shade.
   - Renovation
   - overseeding
   - Aeration (specify type used: deep tine, Vertidrain, etc): recommended at least 1X per year
   - Heavy topdressing
   - Venting (recommended: 1/4" solid tines, monthly during periods of active turf growth)
   - Grooming
   - Vertical mowing
   - Light topdressing
   - Traffic control

Nutrition

Nitrogen toxicity: Although nitrogen levels are either adequate or too low in many cases, excessive levels (>20 ppm) occasionally lead to serious turf damage. In the photograph below, uneven application of nitrogen fertilizer resulted in 77 ppm nitrogen in the damaged areas. The healthy areas had 22 ppm nitrogen.

The nutrients that we most commonly see lacking in golf course soils are potassium (K), phosphorous (P), iron (Fe) and manganese (Mn). For this reason, we have specifically addressed these elements in the planning process described below. If there are other nutrients that you need to regularly supply to your turf, use one of the blank spaces on the Management Plan to indicate the rate and frequency of application. Nitrogen (N) is also frequently low at many courses; but it is also sometimes too high, resulting in serious turf damage. For this reason, extra care needs to be taken selecting the rates and timing of nitrogen applications.

On your Management Plan, use a pencil to mark an "X" to schedule the following:

1. Soil testing (2X per year in spring and fall)
2. Using the cool or warm season N requirements listed on your Climate Appraisal, determine the frequency and rates of nitrogen to be applied. On the nitrogen lines on the Management Plan, indicate the name of the nitrogen product you plan to use, and the product rate per 1000 sq ft or per acre. Use a separate line for each different nitrogen product and/or each different application rate that you plan to use. Some points to keep in mind:

- The rates we refer to are for elemental nitrogen. You will therefore need to convert these rates, depending on the percentage of elemental nitrogen in the fertilizer product that you select, to obtain the rate of product that you will be applying. In the Sample Management Plan that we have provided, we've selected urea, 45-0-0, as our nitrogen source. To calculate the amount of product needed to meet a monthly requirement for 1 lb elemental nitrogen we have divided 1 lb by 45% (1/0.45) to obtain a rate of 2.2 lb/1000 sq ft of urea.
- Use a maximum of 0.25 lb N/1000 sq ft per application. When turf is actively growing, therefore, weekly applications of nitrogen may be necessary in order to meet the monthly needs of the turf.
- The N rates shown on your Climate Appraisal are the **maximum** elemental nitrogen rates for optimal turf growth during each month. At your location and with your specific turf type you may have found through experience that somewhat less nitrogen is optimal (the new "A" and "G" series bentgrasses, for example, require less than the maximum nitrogen rate). If this is the case, stick with what has worked for you in the past, but don't exceed the maximum values indicated on the Climate Appraisal.
- Do not apply more than 1 lb/1000 sq ft nitrogen/ month, unless frequent and heavy rains make re-application necessary (see below).
- In areas that experience heavy rainfall (more than 5 inches per month), maintaining nitrogen levels at adequate levels is a challenge. Under these

conditions, consider the use of granular, long-chain ureaformaldehyde nitrogen sources such as Nitroform 38-0-0. These microbial-release fertilizers are less likely to be leached by rainfall than other N sources. If these products are used, higher rates (2 - 4 lbs nitrogen/1000 sq ft or more) are optimal. Because these rates are higher than those listed on your Climate Appraisal, application will be less frequent. Re-application should occur based on turf performance and color.

- If you are managing both cool and warm season turf in an overseeding situation, select the nitrogen rate based on the turf type whose growth you are trying to encourage. For example, if you are trying to promote growth of cool season turf during the wintertime, then use the nitrogen rates for cool season turf that are suggested on the Climate Appraisal. If you are trying to encourage both turf types to grow, then sum the requirements for warm and cool season turf.

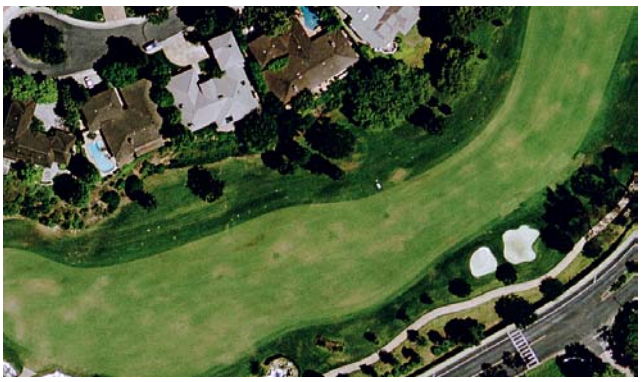
3. Monthly applications of potassium (potash) at 1 lb K_20/1000 sq ft when turf is growing actively (a growth potential of 30% or higher). Remember to include the amount of potassium applied via your nitrogen source in your calculations to determine whether additional potassium is necessary. On the Sample Management Plan, we have selected potassium sulfate, 0-0-50, as our potassium source. Since the urea fertilizer we selected as an N source contained no potassium, the full pound of potassium must come from the 0-0-50.

Water management

On your Management Plan:

1. On the lines “Leaching” and “Salinity Monitoring”, use the yellow highlighter to indicate those months with less than 0.5” rainfall (monthly precipitation can be found on the Climate Appraisal). These months represent additional times of stress for the turf.
2. During these months, you should schedule weekly salinity monitoring (using a TDS-4 meter, as described in *PACE Reference* 8:3), which can be indicated with an “X” on the “Salinity Monitoring” line.
3. Schedule leaching events during these low rainfall months in order to avoid salt accumulation to turf damaging levels. Use your past history to determine the frequency of leaching for the coming year, and indicate with an “X” on the “Leaching” line. If there are no records of past leaching schedules available, then assume that you will need to leach roughly every 14 days during low rainfall months.
4. Schedule irrigation water testing at least once per year. A higher frequency of testing may be required if the water source is of variable quality (i.e. recycled or reclaimed water).
5. Schedule monthly maintenance of the irrigation system: level heads, check pressure, use catch cans to identify problems
6. Schedule drainage improvements in poorly drained areas during time periods compatible with other management and golfer oriented events.
7. Schedule hand watering during heat stress periods
8. Schedule annual aerial photographs during the times of heaviest stress. These can be useful for identifying problem areas, as well as recording changes in overall turf quality over time.

Aerial photography can help identify problems: The impact of low quality reclaimed water on the quality of cool season turf in surrounds is dramatically illustrated in the top photo. Aerial photography can also provide good documentation of the problems that result from poor irrigation distribution (photo below). Aerial photos are also useful for illustrating the damaging effects of shade on turf growth.



What’s next?

The foundation for your 2003 Management Program has now been mapped. It is based on site specific weather data for your course, firm agronomic principles and the strength of your experience and knowledge. In next month’s *PACE Insights,* we will build on this further by incorporating pest management programs into the overall plan.