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DRAFT

INSTRUCTIONS

The IPM Template Roadmap

Congratulations on your decision to develop and implement a comprehensive IPM plan using the IPM Template.

When complete, it will enable you to:

- decrease the incidence of unanticipated turf quality problems
- improve your ability to respond to unexpected problems
- be proactive with regards to environmental protection
- develop IPM plans that address the unique nature of your golf course
- facilitate communication with co-workers, managers and golfers regarding the rationale for IPM strategies, the timing and planning of management practices, and progress towards goals

Recommended sequence of events for completing the IPM Template.

1. Identify a location for storage of all IPM Template documents: for most people, a 3-ring notebook is the most useful
2. Complete Goal Setting Form (30 minutes)
3. Complete the Climate Appraisal Form (available electronically at <http://www.paceturf.org/ipm/>) (30 minutes)
4. Complete Management Zone Inventory Form (1 – 2 hours). Available as printable form to be filled out with pencil and paper or as electronic form at <http://www.paceturf.org/ipm/>
5. Complete the Pest Worksheet Form for each management zone (1-2 hours/management zone). Available as printable form to be filled out with pencil and paper or as electronic form at <http://www.paceturf.org/ipm/>
6. Complete the IPM Planner Form for each management zone (2 – 3 hours per management zone). Available as printable form to be filled out with pencil and paper or as electronic form at <http://www.paceturf.org/ipm/>
7. Complete the Budget Worksheet. Available as printable form to be filled out with pencil and paper or as electronic form at <http://www.paceturf.org/ipm/>
8. Update your goals and plan quarterly

Scheduled events, once the IPM Template has been completed: Your final IPM Planner is a living, dynamic document that should be regularly reviewed and updated. The calendar below suggests a timeframe for this process. Month 1 should be whichever month you regard as the start of your planning year.

INSTRUCTIONS

The IPM Template Roadmap

	MONTH											
	1	2	3	4	5	6	7	8	9	10	11	12
Set goals												
Review goals												
Develop new IPM Plan												
Review IPM Plan; make necessary changes												

A tool with many uses

Your completed IPM plan has many potential uses. In addition to serving as the basis of your planning activities, it can be a very useful way of soliciting input from your crew and/or training your crew in IPM practices. By having your colleagues and employees at the golf course fill out portions of the template or even the entire template separately, you can then compare and integrate your results. It is not only a learning process, but will also add further dimensions and practicality to the final product.

The completed IPM Planner is also a powerful way to communicate with managers the agronomic basis for scheduling, agronomic practices, and adoption of IPM practices.

Good luck, and happy planning!

What is the Goal Setting Form?

This first step in the IPM Template process encourages you to identify the goals that you hope the Template process will help you to achieve.

What is the Goal Setting Form used for?

- an internal guide that will help you assess your progress
- a communication tool that explains to managers and crews the vision that you have for the golf course

Estimated time: 30 minutes

Materials Needed

Forms: The “Goal Setting Form” (included in IPM Template Kit). Available as printable form to be filled out with pencil and paper or as electronic form at <http://www.paceturf.org/ipm/>

Instructions

- If you are entering your information using your computer, open the [goal setting form file](#). Click on “save as” in the “File” menu, choose an appropriate location on your computer to save the file (we suggest that you create an “IPM Template” folder for all of your files) and name the file appropriately. For file naming, we suggest the current date followed by the word “goals” (example: 2010_0513_goals). Once the file has been saved on your computer, you can begin work on it.
- Identify roughly 3 to 5 goals in each of three main categories shown on the form.
 - agronomic
 - environmental
 - budgetary
- An “other” category is included to allow customization of goals that fit your specific circumstances.
- Goals should be tangible, as specific as possible, realistic and should have a targeted completion date. Some examples of agronomic, budgetary and environmental goals are listed below:
 - Identify methods for reducing organic matter on greens, and select optimum methods for this location by September, 2009 (agronomic).
 - Reduce organic matter on greens from current levels of 5-6% down to 2% by the end of 2010 (agronomic).
 - At the end of 2010, identify reductions in earthworms and insect pests, as well as improvements in firmness and water movement that result from organic matter management (agronomic)
 - Replace Dursban applications made for caterpillar pests with appropriate cultural practices and/or more environmentally compatible insecticides (environmental) by the end of this year.

INSTRUCTIONS

Goal setting

- Reduce pesticide in puts on fairways and roughs by utilizing spot treatments (as opposed to broadcast treatments) of pesticides whenever appropriate. Document the annual acreage treated with pesticides to measure progress (environmental and budgetary). Complete by year end.
- Review goals quarterly to assess progress and make adjustments. Identify new goals at the start of each new year or new season, whichever is most convenient for you.

What is the Climate Appraisal Form?

The Climate Appraisal Form is a powerful tool on which will serve as the foundation for all of your IPM planning. Based on 30-years of weather data (obtained from the closest weather station to your site), it provides a one-sheet snapshot of the month-to-month weather conditions that you can expect at your location.

What is the Climate Appraisal Form used for?

- Completing the Pest Worksheet and the IPM Planner
- Predicting turf growth, performance, stress, nitrogen demand
- Planning management strategies to optimize turf growth
- Explaining turf performance at different times of the year

Estimated time involved (steps I – IV): 30 minutes

Materials Needed

Forms:

- The “Climate Appraisal Form” Excel spreadsheet (available in metric or English units). These forms are currently available on the internet at www.paceturf.org/ipm

Other:

- A computer equipped with Microsoft Excel

Instructions

1. Visit a climate information website such as:
 - <http://www.worldclimate.com/>
 - <http://www.weatherbase.com/>
2. Locate the average monthly air temperatures and average monthly precipitation for your location (if your location is not included in either of these databases, try entering the names of nearby locations with similar weather patterns). Print this information out. (Note: In addition to average air temperatures, many websites will also list the average high and low temperatures for a location, but **do not use** the high and low temperature information).
3. Open up the [Climate Appraisal Form \(English Units\)](#) or the [Climate Appraisal Form \(Metric Units\)](#). These are Excel spreadsheets, so you will need to have Excel installed on your computer.
4. Click on “save as” in the “File” menu, choose an appropriate location on your computer to save the file (we suggest that you create an “IPM Template” folder for all of your files) and name the file appropriately. For file naming, we suggest the current date followed by the word “climate appraisal” (example: 2010_0513_climate_appraisal). Once the file has been saved on your computer, you can begin work on it.

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Climate appraisal form

5. Type the following information onto your spreadsheet, using the monthly data that you printed out in step #2:
 - the average air temperature information for each month
 - the average precipitation information (in inches or cm, whatever your preference) for each month
 - the maximum rate of nitrogen that you wish to use per month on your cool-season turf
 - the maximum rate of nitrogen that you wish to use per month on your warm-season turf
6. Once the data has been entered, estimates of turfgrass growth and nitrogen requirements will be visible on the form.
7. Print this form out.

The next step

Complete the Management Zone Inventory

Reading your Climate Appraisal Form

The Climate Appraisal Form that you have just generated is based on the average of 30 years of climate data (the “30 year normals”) from a weather station that is as close as possible to your golf course. Once you complete it, it will include the following information:

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 GP”) and warm season turf (“warm GP”). Explained in greater detail in the Growth Potential Reference, the turf growth potential values are estimates of the growth of cool or warm season turf based on expected monthly air temperatures. Values range from 0 to 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.

Periods of turf stress: When growth potential values are less than 50%, the turf is considered to be under stress. You may want to use a yellow highlighter to note stress periods on your Climate Appraisal Form.

Maximum nitrogen requirements: Maximum monthly N requirements have been calculated based on the projected growth potential of cool or warm season turf. We have set the maximum monthly requirement for any turf type at any time at 0.7 lb/1000 sq ft of elemental N. You should not exceed these values, unless you are in an area with heavy rainfall (greater than 5 inches/month; see below for more information).

Note on nitrogen demand in heavy rainfall areas: *In areas that experience heavy rainfall (more than 5 inches per month), maintaining nitrogen levels at adequate levels is*

INSTRUCTIONS

Climate appraisal form

a challenge. Under these conditions, the maximum rates of 1 lb elemental N/1000 sq ft/month may need to occasionally be exceeded. 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.

INSTRUCTIONS

Filling out the Management Zone Inventory

What is the Management Zone Inventory?

Management zones are geographic areas of the golf course that have common management features. For example, greens frequently are similar in construction and management requirements and can be grouped in the overall category called “Greens”. Similar zones can be constructed for fairways, tees, roughs and special management areas such as buffers around water features.

What is the Management Zone Inventory used for?

- To help organize management plans into logical groups with common management goals.
- To identify areas of high risk of damage by pests.
- To aid in reduction of pesticide usage to areas of high risk or pest impact.
- To streamline management programs and record keeping.
- To identify sensitive areas where nutrient and pest management may require special care, for example fertilizing near water features.
- To enhance communication between superintendents and golfers.

ESTIMATED TIME INVOLVED: 1 – 2 HOURS

MATERIALS NEEDED

- Blank **Management Zone Inventory Form**. Available as printable form to be filled out with pencil and paper or as an [electronic form](#).
- OPTIONAL: Soil survey map (<http://websoilsurvey.nrcs.usda.gov/app/>)
- OPTIONAL: As-built map, aerial photograph, or Google Earth aerial images that can be used for mapping management zones

PROCEDURE

1. For electronic form entry: Open the [electronic entry Management Zone Inventory](#). Click on “save as” in the “File” menu, choose an appropriate location on your computer to save the file (we suggest that you create an “IPM Template” folder for all of your files) and name the file appropriately. For file naming, we suggest the current date followed by the word “management zone” (example: 2010_0513_management_zone). Once the file has been saved on your computer, you can begin work on it.
2. Identify Management Zones: The basic management zones are Greens, Greens Surrounds, Tees, Fairways and Roughs. Additional zones should be added as needed to represent Trees, Landscape, Streams, Lakes, Buffer zones and any other area that is handled with specific management needs.
3. Identify management subzones: The subzones are the smallest management area that requires special management practices. For example, there are frequently several soil types running through a golf course or high traffic areas where additional

INSTRUCTIONS

Filling out the Management Zone Inventory

management practices are needed. If different fertility or cultivation is needed separate subzone should be used. For example fairways 4 and 6 may require additional aeration. These areas should be designated as a subzone such as F04 and F06. Green 5 must have fans installed between the months of June and September. This subzone might be designated G05.

4. Identify soil type subzones (OPTIONAL):

- Develop soil subzone maps by using self-generated soil survey data from soil testing or experience or by using data available from Natural Resources Conservation Service (NRCS) soil surveys (<http://websoilsurvey.nrcs.usda.gov/app/>). If your resources and/or budget allow, more detailed information can be provided through a site visit and report from the NRCS, or through web mapping services offered by companies such as Coursevision (<http://groundlinkx.com/index.php?/site/features/C13/>).
- Try to be as simple and logical as possible using standard golf course references such as greens, aprons, tees and fairways. Combine fairways, greens and/or tees that have similar soil conditions and therefore similar management requirements in to the same subzone. For example, all USGA spec sand greens of similar age are an example of a soil type subzone that could be labeled G01-sand, while all pushup greens could be labeled G01-pushup. The sand-based greens would be managed differently than the pushup greens in terms of fertility, irrigation and other cultural practices. All fairway and rough areas characterized by heavy clay could be labeled F01/R01-clay, and would be managed differently than other subzones.
- Use the “description” area on the Management Zone Inventory to record information on the areas characterized by each subzone (for example, “poorly drained heavy clay soils on fairways 2 and 7 and roughs 3 and 6”). Attach maps, when available, to identify, as precisely as possible, the areas characterized by each subzone.
- Identify pest subzones: In some cases, there are areas that are particularly conducive to pest, weed, or insect invasion and damage. Identifying these areas may result in reduced pesticide inputs by accomplishing the goal of pest control without treating the entire zone. For example, green 5 may be in a poor location that results in heavy pressure from pythium during the summer months. Consider separating out green 5 for increased pythium management rather than treating all greens more aggressively for pythium. A separate management program would be developed for green 5 with the subzone identified as G05.

THE NEXT STEP

Complete the Pest Worksheet

INSTRUCTIONS

Filling out your Pest Worksheet

What is the Pest Worksheet?

The Pest Worksheet is an intermediate step in developing your IPM Plan that enables you to clearly identify your key pests, as well as the practices and products that you want to use to manage them. Portions of the information that you generate on this worksheet will be transferred onto your final **IPM Plan**.

Estimated time involved (steps I – IV): 2 hours per management zone

Materials Needed

Completed forms

- Completed **Climate Appraisal Form**
- Completed **Management Zone Inventory**

Forms:

- A blank **Pest Worksheet** for each of the management zones on your golf course. Available as a printable form to be filled out with pencil and paper or as an electronic form

Examples:

- A sample **Pest Worksheet** that has already been completed is provided for guidance.

Instructions:

- **Filling out your Pest Worksheet** (this document)

References:

- **Assorted “Pest References”** on each targeted pest
- **“Using threat temperatures for IPM Planning”**

Other:

- pencil with eraser
- yellow highlighter
- computer equipped with Microsoft Excel (if using electronic forms)

Instructions

You will need to fill out a separate Pest Worksheet for each of the management zones that you have identified in your **“Management Zones Inventory”**.

I. Insect Pests

On your **Pest Worksheet**, list the top 5 insect pests that you deal with in the management zone of interest, in order of importance. The first insect listed (I-1) should be your most important insect pest, while I-5 represents the least important. Then, for each insect listed:

INSTRUCTIONS

Filling out your Pest Worksheet

1. Determine control strategy:

- Decide whether you want to use preventive control (treatment BEFORE the insect appears) or curative control (treatment AFTER the insect appears).
- Use a “P” or “C” in the column next to each insect’s name to indicate whether you plan to use preventive or curative control.
- Consult the **Pest References** (or other available reference information) for each of your target pests for information on the feasibility of preventive vs. curative control for each pest.
- If you opt for preventive control based on a history of infestation with this pest, consider attaching documentation of past infestations (notes, photos, etc) to the final version of your Pest Worksheet.

Preventive vs. curative control? Which one fulfills your IPM goals best?

Which management strategy is more in line with IPM principles — preventive or curative? In our opinion, this is an irrelevant question. The more useful question to ask is: “Based on what we know about this particular pest and about its history at this location, which strategies will be most effective, while at the same time the most economical and environmentally compatible?”

For some pests — particularly those that are the most destructive, the most difficult to scout for and/or the most difficult to control, preventive control (treatment BEFORE the pest appears) is not only the most effective strategy, but is frequently the most environmentally and economically appealing strategy. A pest that requires preventive control at one location, due to a long history of difficult control, may not require preventive control at another location, where its numbers have been light enough to warrant very little concern.

Preventive measures include a wide variety of techniques, from the selection of pest-resistant varieties of turf, to cultural practices that improve plant health and therefore pest resistance, to application of pesticides in advance of symptoms of pest infestation. To time preventive pesticide applications, consult the Reference, “**Using threat temperatures for IPM Planning**”, and use this in conjunction with current weather data from your location.

Curative measures, which are taken AFTER the pest or its symptoms are detected, are usually employed when the pest is easily controlled and/or it has caused minimal damage in the past at your location. In some cases, there are threshold levels of the pest or its damage that are used to trigger a control procedure. For these pests, scouting for early signs of pest activity is very important. The Reference “**Using threat temperatures for IPM Planning**”, provides information on the threat temperatures that should trigger scouting for key pests.

- ### 2. Determine target life stage: Determine whether your control measures will target larvae (“L”) or adults (“A”) or both by consulting **Pest References** (or other available

INSTRUCTIONS

Filling out your Pest Worksheet

reference information) for each of your target pests. Indicate the target life stage with an “L” or “A”.

3. Determine when insects are likely to appear:

- Consult the Weather Reference entitled “**Using threat temperatures for IPM Planning**” to determine the conditions that are conducive to development of each of your key pests. To confirm the accuracy of the forecasted threat period, review your historical records (if available) and identify the earliest date and the latest date that the targeted stage of each pest has been observed in the past. These dates define the beginning and end of the insect’s **threat period**. Now, on your Pest Worksheet, use a yellow marker to highlight the threat period for each insect. If using the electronic Pest Worksheet form, use the “shading” option in Excel to highlight each insect’s threat period. We typically use a fill color of yellow, but any light color will do.
 - Ideally, each of the two methods above identify similar threat periods. If they differ somewhat, it is safest to assume the earliest start date and the latest stop date — in other words, the longest threat period possible.
- ### 4. Decide when to begin control measures: Using your **Pest References** (or other available reference information), determine when control measures for each insect should begin. If available, you should also consult historical records to see on which dates successful control measures were implemented in the past. Mark an “X” on the appropriate line of your Pest Worksheet to indicate potential dates for starting chemical, biological or cultural control measures.
- ### 5. Decide where to make control measures: If pesticide applications are called for, consult historical records, management zone forms and/or scouting records and maps to determine whether pests require broadcast applications, or whether pesticide inputs can be reduced by using spot applications. Mark a “B” (for broadcast) or “S” (for spot treatment) next to the name of each pest, based upon your decision.

II. Diseases

On your **Pest Worksheet**, list the top 5 diseases that you deal with in the management zone of interest, in order of importance. The first disease listed (D-1) should be your most important disease, while D-5 represents the least important. Then, for each disease listed:

1. Determine control strategy:

- Decide whether you want to use preventive control (treatment BEFORE the pest appears) or curative control (treatment AFTER the pest appears).
- Use a “P” or “C” in the column next to each pest’s name to indicate whether you plan to use preventive or curative control.
- Consult the **Pest References** (or other available reference information) for each of your target pests for information on the feasibility of preventive vs. curative control. If you are uncertain, a good rule of thumb is to focus on preventive

INSTRUCTIONS

Filling out your Pest Worksheet

control if you have had a history of problems with the disease in question, and curative control to deal with less serious problems as they arise.

- If you opt for preventive control based on a history of infestation with this pest, consider attaching documentation of past infestations (notes, photos, etc) to the final version of your Pest Worksheet.

2. Determine when diseases are likely to appear:

- Consult the Weather Reference entitled “**Using threat temperatures for IPM Planning**” to determine the conditions that are conducive to development of each of your key pests. To confirm the accuracy of the forecasted threat period, review your historical records (if available) and identify the earliest date and the latest date that the targeted stage of each pest has been observed in the past. These dates define the beginning and end of the disease’s **threat period**. Now, on your Pest Worksheet, use a yellow marker to highlight the threat period for each disease. If using the electronic Pest Worksheet form, use the “shading” option in Excel to highlight each insect’s threat period. We typically use a fill color of yellow, but any light color will do.
- Ideally, each of the two methods above identify similar threat periods. If they differ somewhat, it is safest to assume the earliest start date and the latest stop date — in other words, the longest threat period possible.

3. Decide when to begin control measures: Mark an “X” on your **Pest Worksheet** to indicate potential dates for starting control measures (chemical, biological or cultural). For preventively controlled diseases, begin treatment 2-4 weeks before the threat period begins (4 weeks for root infecting diseases such as summer patch, take-all patch, spring dead spot, Bermuda decline). For curatively controlled diseases, place an “X” at the beginning of the threat period.

4. Decide where to make control measures: If pesticide applications are called for, consult historical records, management zone forms and/or scouting records and maps to determine whether pests require broadcast applications, or whether pesticide inputs can be reduced by using spot applications. Mark a “B” (for broadcast) or “S” (for spot treatment) next to the name of each pest, based upon your decision.

III. Weeds

On your **Pest Worksheet**, list the top 5 weeds that you deal with in the management zone of interest, in order of importance. The first weed listed (W-1) should be your most important weed, while W-5 represents the least important. Then, for each weed listed:

1. Determine control strategy:

- Decide whether you want to use preventive control (treatment BEFORE the pest appears) or curative control (treatment AFTER the pest appears).
- Use a “P” or “C” in the column next to each pest’s name to indicate whether you plan to use preventive or curative control.

INSTRUCTIONS

Filling out your Pest Worksheet

- Consult the **Pest References** (or other available reference information) for each of your target pests for information on the feasibility of preventive vs. curative control. If you are uncertain, a good rule of thumb is to focus on preventive control if you have had a history of problems with the disease in question, and curative control to deal with less serious problems as they arise.
 - If you opt for preventive control based on a history of infestation with this pest, consider attaching documentation of past infestations (notes, photos, etc) to the final version of your Pest Worksheet.
2. Determine when weeds are likely to appear:
- Consult the Weather Reference entitled “**Using threat temperatures for IPM Planning**” to determine the conditions that are conducive to development of each of your key pests. To confirm the accuracy of the forecasted threat period, review your historical records (if available) and identify the earliest date and the latest date that the targeted stage of each pest has been observed in the past. These dates define the beginning and end of the weed’s **threat period**. Now, on your Pest Worksheet, use a yellow marker to highlight the threat period for each weed. If using the electronic Pest Worksheet form, use the “shading” option in Excel to highlight each insect’s threat period. We typically use a fill color of yellow, but any light color will do.
 - Ideally, each of the two methods above identify similar threat periods. If they differ somewhat, it is safest to assume the earliest start date and the latest stop date — in other words, the longest threat period possible.
3. Decide when to begin control measures: Mark an “X” on your **Pest Worksheet** to indicate potential dates for starting control measures (chemical, biological or cultural). Consult the appropriate **Pest References** (or other available reference information) for more information.
4. Decide where to make control measures: If pesticide applications are called for, consult historical records, management zone forms and/or scouting records and maps to determine whether pests require broadcast applications, or whether pesticide inputs can be reduced by using spot applications. Mark a “B” (for broadcast) or “S” (for spot treatment) next to the name of each pest.

IV. Other pests

Pests such as birds and rodents that do not fall into the disease, insect or weed categories should be listed on your **Pest Worksheet** as well, using O-1 through O-5 to designate pests from most to least importance. Then, for each “other” pest listed, follow the instructions under Section II (Diseases), modifying as necessary.

V. The next step

Use the information generated on the **Pest Worksheet** to complete the **IPM Planner**

INSTRUCTIONS

Filling out your IPM Planner

What is the IPM Planner?

Your completed **IPM Planner** represents the culmination and final step of your IPM Planning process. In a single sheet of paper, it summarizes the complex interactions among forces such as climate, pests, turf growth and golf play and demonstrates the science and logic on which your IPM agronomic practices are based. You will need to develop a separate IPM planner for each of your management zones.

What is the IPM Planner used for?

- The blueprint for your annual IPM Plan
- A planning, communication and organizing tool for scheduling, purchasing, budgeting and coordinating
- A communication tool for explaining the science and logic behind your IPM strategies to your crew, your managements, golfers and other superintendents

Estimated time involved: 2 – 3 hours per management zone

Materials Needed

Completed forms and worksheets

- Completed **Climate Appraisal**
- Completed **Pest Worksheet Form**
- Completed **Management Zones Inventory Form**

Forms:

- A blank **IPM Planner Form** for each of the management zones on your golf course. Available as paper form to be filled out by hand, or electronically at: <http://www.paceturf.org/ipm/>

Examples:

- A **sample IPM Planner** that has already been completed is provided for guidance.

Instructions:

- **Filling out your IPM Planner** (this document)

References:

- Monitoring Salinity
- Pesticide Resistance Management
- Using Threat Temperatures for IPM Planning
- Using Growth Potentials for IPM Planning
- Assorted “Pest References” on each targeted pest
- Turf Sensitivity to Herbicides

Other:

- pencil with eraser
- yellow highlighter
- computer equipped with Microsoft Excel (if using electronic forms)

INSTRUCTIONS

Filling out your IPM Planner

Instructions

You will need to fill out a separate IPM Planner Form for each of the management zones that you have identified in your “**Management Zones Inventory**”.

Article I. I. Map periods of turf stress

1. On your **IPM Planner form**, use the yellow highlighter (or yellow shading tool if using electronic form) to indicate periods of high or low temperature stress for cool season turf and warm season turf. These periods should also be highlighted in yellow on your **Climate Appraisal**. If you are managing only cool season turf on your greens, then you can ignore the warm season turf data (and vice versa)
2. 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. Mark a “T” to indicate planned tournament dates on either the cool or warm season stress lines.

Article II. II. Schedule agronomic practices

Mark an “X” to schedule cultural practices such as those listed below. Avoid scheduling aggressive agronomic 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): in most cases, at least 1X per year
- Heavy topdressing
- Venting (recommended: 1/4” solid tines or deep slicing with equipment such as Planet Air, monthly during periods of active turf growth [>30% growth potential])
- Grooming
- Vertical mowing
- Light topdressing
- Traffic control

III. Schedule soil nutrition

On your **IPM Planner Form**, Mark an “X” to schedule the following:

1. Soil testing (2X per year in spring and fall)
2. Nitrogen applications:

INSTRUCTIONS

Filling out your IPM Planner

- Determine the type of nitrogen product and the weekly rate of application, and write this information in the columns just to the right of the “nitrogen” line on your IPM Planner Form. Use a different line for each different nitrogen product. To calculate the optimal N rate of application, follow these steps:
 - a. Find the **maximum rate of elemental N/month** for your location by looking at the cool or warm-season monthly N requirements listed on your **Climate Appraisal**. Keep in mind that this rate will be converted (later on in this exercise) into the rate of product needed to deliver the specified amount of elemental N.

Keep in mind that the nitrogen rates shown in the Climate Appraisal are the maximum amounts that should be used at your location. In other words, these are the amounts that should not be exceeded. For this reason, you may want to use lower rates than those shown in the Climate Appraisal.

How do you determine how much to lower the rates (if at all) shown in the Climate Appraisal? We have assumed that 0.7 lb elemental N/1000 sq ft/month is the maximum that should be used when the turf is growing at full capacity. If this is a higher rate of nitrogen than you use during the peak growth months, then you should decrease all of the amounts shown in the Climate Appraisal accordingly. For example, if the maximum rate of elemental N you have applied (with good results) is 0.5 lb elemental N/1000 sq ft/month, then all nitrogen values in the Climate Appraisal should be decreased to 71% of the printed value ($0.5/0.7 = 71.4\%$).
 - b. Determine the **weekly rate of elemental N** by dividing the monthly rate by 4. In the example above, a monthly rate of 0.5 lb elemental N/1000 sq ft/month becomes 0.125 lb/1000 sq ft/week.
 - c. Now, determine the **weekly rate of nitrogen product** that will be applied. To do this, you will need to know the percentage of elemental nitrogen in the fertilizer product that you have selected. . In the Sample IPM Planner that we have provided, we’ve selected urea, 45-0-0, as our nitrogen source. And we have selected, for this example, to never apply more than 0.5 lb/1000 sq ft elemental N/monthly (0.125 lb/1000 sq ft/week). Therefore, to calculate the amount of product needed to deliver 0.125 lb/1000 sq ft elemental N per application, we have divided 0.125 lb by 45% ($0.125/0.45$) to obtain a rate of 0.28 lb/1000 sq ft of urea per application.
 - d. Finally, determine the **frequency of application** by marking an “X” for each week that an application is planned. Remember that the number of applications you make each month (anywhere from 0 to 4), will be determined by the maximum monthly amount you want to apply.
- Note on nitrogen demand in heavy rainfall or low nutrient-holding soil (sandy, low TEC) areas: In areas that experience heavy rainfall (more than 5 inches per month), or 100% sand greens, maintaining nitrogen levels at adequate levels is a challenge. Under these conditions, the maximum rates of 1 lb elemental N/1000

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Filling out your IPM Planner

sq ft/month may need to occasionally be exceeded. 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.

- **Note on overseeded turf:** 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 types of turf to grow, then use the higher of the two nitrogen rates shown on your Climate Appraisal.
4. Schedule monthly applications of potash as a potassium source at 1 lb K₂O/1000 sq ft when turf is growing actively (a growth potential of 30% or higher). Remember to include the amount of potash applied via your nitrogen source in your calculations to determine whether additional potash is necessary. On the Sample IPM Planner, 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 potash must come from the 0-0-50. Since the 0-0-50 contains 50% potash, we will need $1 \text{ lb}/0.50 = 2.0 \text{ lbs}/1000 \text{ sq ft}$ of 0-0-50 to meet the requirement for 1.0 lb potash per month.
 5. Schedule any other nutrient applications that your soils require in blank lines on the management plan.

IV. Schedule water/irrigation management

1. Leaching and salinity monitoring activities (of particular importance for areas with low rainfall and/or poor quality irrigation water).

Using your **IPM Planner Form**:

- On the lines “Leaching” and “Salinity Monitoring”, use a yellow highlighter (or yellow shading option in Microsoft Excel if using electronic entry form) 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.
- During these months, you should schedule weekly salinity monitoring (using an EC meter, as described in the “**Monitoring Salinity**” Reference) which can be indicated with an “X” on the “Salinity Monitoring” line.
- 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,

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then assume that you will need to leach roughly every 14 days during low rainfall months.

2. Mark an “X” to 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).
3. Use “X”s to schedule monthly maintenance of the irrigation system: level heads, check pressure, use catch cans to identify problems
4. Use “X”s to schedule drainage improvements in poorly drained areas during time periods compatible with other management and golfer oriented events.
5. Schedule hand watering during heat stress periods

V. Schedule aerial photography

On your **IPM Planner Form**, use an “X” to schedule annual aerial photographs during the times of heaviest stress. These can be useful for identifying problem areas, as well as documenting changes in overall turf quality over time.

Congratulations! You have just successfully completed the first half of your IPM Planner. This is a good time to take a look at the work you have done so far and (this is why you used a pencil and/or a computer to enter your initial data), to look for any conflicts in your schedule. For example, are any of your agronomic practices scheduled too close to tournaments? Are there practices scheduled for separate days that it would be more efficient to schedule for the same day?

VI. Insect IPM

Using the information on your completed **Pest Worksheet** and in the **Pest References**, do the following for each of your target insects:

1. Select IPM strategies for preventively controlled insects: Begin by focusing on the most important of the preventively controlled insects that you have listed on your **Pest Worksheet**. Go through the entire process described below for one insect at a time.
 - a. Using the **Pest References** that have been supplied for each of your target pests, select the optimum practice(s) or product(s) for each preventively controlled insect that you have listed on your **Pest Worksheet**.
 - b. List the names of these products or practices on the **IPM Planner Form**. If product applications are called for, consult your Pest Worksheet to determine whether broadcast or spot applications are required, and write a “B” or an “S” next to each product to indicate whether a broadcast application or a spot application is called for. If spot applications are required, attach a map or written information that clearly identifies the areas to be treated.

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- c. Use the most current product labels to determine the rate that you plan to use, and indicate this rate on the **IPM Planner Form** as well. If there are any specific application guidelines (volume of application, watering in requirements, nozzle types, etc.) identified on the product label or in your **Pest References**, make a note of these next to each product name.
 - d. Use the letter “X” to indicate the timing of application for each of the products or practices. Consult your **Pest Worksheet** for information on when to initiate applications. Consult product labels for frequency of follow-up applications, and indicate these applications with additional “X”s.
 - e. Go through the same procedure for the remaining preventively controlled insects.
2. Select IPM strategies for curatively controlled insects: For these insects, it is almost impossible to predict exactly when control measures will be necessary – their timing will be based on when the insects are detected in your monitoring program. For this reason, the most important activity you can schedule for curatively controlled insects is monitoring.
 - a. Using the **Pest References** for each of your target insects, determine at which temperatures monitoring for each insect should occur (note that monitoring isn’t absolutely necessary for those insects that are habitual problems and are preventively controlled).
 - b. Using your **Climate Appraisal**, determine when those monitoring temperatures begin.
 - c. Now, on your **IPM Planner Form**, write the name of the monitoring practice in the left hand column, and place an “X” at the time the practice should begin. Place additional “X”s roughly every two weeks during the insect’s threat period.
 - d. Follow steps 1a -1c above for each curatively controlled insect.
 - e. For purposes of budgeting and/or planning, you may want to make some rough guesses on when control measures for curative insects will be made. Your records from previous years may be the most helpful in this respect – you can mark a tentative “(X)”, in parentheses to indicate it’s based on last year’s data, on the dates when you performed control measures last year. You will also find a listing of control measures at the end of the **Pest Reference** for each of your targeted insects.
 - f. Go through the same procedure for the remaining curatively controlled insects.
3. Identify target insects: It is important to clearly document the pest (or pests) that you are targeting with each product or practice. To do this, find the number of the insect pest (I1-I5) on your **Pest Worksheet** and enter it on your **IPM Planner Form** next to each management or monitoring practice that it addresses. Some practices will probably target multiple insect pests.

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Filling out your IPM Planner

4. Refine your program: Now take a look at your insect management program. Can you streamline the program any further by targeting two or more insects with the same product or practice? By moving application dates around by one or two weeks? Are you targeting the right insect life stage with the right product? Have you taken into account resistance management guidelines, which recommend that you rotate among insecticide classes (see the **“Insecticide Resistance Management” Reference**)? Don’t become frustrated if you do a lot of erasing during this step – the idea is to get you to try out on paper several scenarios, and then judge which is the most efficient, most economically attractive, and most effective.

VII. Disease IPM

Using the information on your completed **Pest Worksheet** and in the **Pest References**, do the following for each of your target diseases:

1. Select control measures for preventively controlled diseases: Begin by focusing on the most important of the preventively controlled diseases that you have listed on your **Pest Worksheet**. Go through the entire process described below for one disease at a time.
 - a. Using the **Pest References** that have been supplied for each of your target pests, select the optimum practice(s) or product(s) for each preventively controlled disease that you have listed on your **Pest Worksheet**.
 - b. List the names of these products or practices on the **IPM Planner Form**. If product applications are called for, consult your Pest Worksheet to determine whether broadcast or spot applications are required, and write a “B” or an “S” next to each product to indicate whether a broadcast application or a spot application is called for. If spot applications are required, attach a map or written information that clearly identifies the areas to be treated.
 - c. Use the most current product labels to determine the rate that you plan to use, and indicate this rate on the **IPM Planner Form** as well. If there is a choice in spray interval frequencies, the 14 day interval (with the 14 day rate recommendation) is usually optimal. If there are any specific application guidelines (volume of application, nozzle types, watering in requirements, etc.) identified on the product label or in your **Pest References**, make a note of these next to each product name.
 - d. Use the letter “X” to indicate the timing of application for each of the products or practices. Consult your **Pest Worksheet** for information on when to initiate applications. Consult product labels for frequency of follow-up applications, and indicate these applications with additional “X”s.
 - e. Determine optimum product placement by consulting the **Pest Reference** for each specific disease. For each product, write an “S” for soil applications or an “F” for foliar applications. Foliar or crown placement relies on low volume

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Filling out your IPM Planner

applications of 1-2 gallons/1000 sq ft, while soil (root) placement relies on higher volume applications of 2 – 4 gallons/1000 sq ft (or low volume applications watered in with approximately 0.1 inches of irrigation).

- f. Go through the same procedure for the remaining preventively and curatively controlled diseases. Remember that the timings for curatively controlled pests are going to be rough guesses at best – you will want to use monitoring to confirm that curatively controlled diseases are present before beginning control measures.
2. **Monitoring:** Follow the guidelines for monitoring practices and timing in each of the **Pest References**. Write the name of the monitoring practices that you want to implement in the left hand column of your **IPM Planner Form**, and place an “X” at the time you should begin. Place additional “X”s roughly every two weeks during the disease’s threat period.
3. **Identify target diseases:** It is important to clearly document the pest (or pests) that you are targeting with each product or practice. To do this, find the number of the disease (D1-D5) on your **Pest Worksheet** and write it down on your **IPM Planner Form** next to each management or monitoring practice that it addresses. Some practices will probably target multiple diseases.
4. **Refine your program:** Now take a look at your disease management program, and refine it as you did your insect program. Also, make sure that the disease threat periods are sufficiently covered by your control measures. Remember that in many cases, preventive control practices will also control diseases that are listed for curative control. Have you taken into account resistance management guidelines, which recommend that you rotate among fungicide classes (see the “**Fungicide Resistance Management**” Reference)?

VIII. Weed IPM

Using the information on your completed **Pest Worksheet** and in the **Pest References**, do the following for each of your target weeds:

1. **Select control measures:** Begin by focusing on your most important pre-emergence weed that you have listed on your **Pest Worksheet**. Go through the entire process described below for each weed.
 - a. Using **Pest References** that have been supplied for each of your target pests, select the optimum practice(s) or product(s) for each preventively controlled weed that you have listed on your **Pest Worksheet**. Remember to take into account the sensitivity of your specific turf type to each weed control product (see “**Turf Sensitivity to Herbicides**” Reference)
 - b. List the names of these products or practices on the **IPM Planner Form**. If product applications are called for, consult your Pest Worksheet to determine whether broadcast or spot applications are required, and write a “B” or an “S” next to each product to indicate whether a broadcast application or a spot

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Filling out your IPM Planner

- application is called for. If spot applications are required, attach a map or written information that clearly identifies the areas to be treated.
- c. Use the most current product label versions to determine the rate that you plan to use, and indicate this on the **IPM Planner Form** as well. If there are any specific application guidelines (volume of application, watering in requirements, nozzle types, etc.) identified on the product label or in your **Pest References**, make a note of these next to each product name.
 - d. Use the letter “X” to indicate the timing of application(s) for each of the products or practices. Consult your **Pest Worksheet** for information on when to initiate applications. Consult product labels and your **Pest References** for frequency of follow-up applications, and indicate these applications with additional “X”s. Make sure that product residual activity is long enough to control each target pest.
 - e. Go through the same procedure for the remaining pre- and then post-emerge controlled weeds. Remember that the timings for post-emergence weeds are going to be rough guesses at best – you will want to use monitoring to confirm that these weeds are present before beginning control measures
2. **Monitoring** is especially important for weeds that are controlled post-emergence. Write the name of the monitoring practices that you want to implement (for post-emergent weeds, it is usually “visual monitoring”) in the left hand column of your **IPM Planner Form**. Use your **Climate Appraisal** and the **Pest Reference** for each weed to determine when visual monitoring begins. Mark with an “X” on the **IPM Planner Form** at the time you should begin monitoring, and place additional “X”s roughly every two weeks for as long as conducive temperatures are forecasted to exist in your **Climate Appraisal**.
 3. **Identify target weeds:** It is important to clearly document the pest (or pests) that you are targeting with each product or practice. To do this, find the number of the disease (W1-W5) on your **Pest Worksheet** and write it down on your **IPM Planner Form** next to each management or monitoring practice that it addresses. Some practices will probably target multiple weeds.
 4. **Refine your program:** Now take a look at your weed management program and refine it. In addition, make sure that you have taken overseeding timing and turf sensitivities (“**Turf Sensitivity to Herbicides**” **Reference**) into account. Have you incorporated resistance management guidelines, which recommend that you rotate among pesticide classes (“**Herbicide Resistance Management**” **Reference**)?

IX. Other pests

Pests that cannot be classified as insects, diseases or weeds can of course still be important pests. Birds and rodents fall into this category, for example. To include these “other” pests in your plan, follow the instructions under Section VII (Diseases) and modify as necessary, depending on the pest in question.

X. Almost Done!

INSTRUCTIONS

Filling out your IPM Planner

The next-to-final step in this process is to look over your entire IPM Planner Form and make any necessary adjustments. Some of the questions you should be asking yourself include:

- Are cultural practices being taken full advantage of in order to maximize turf health and potentially reduce pesticide applications?
- Are there stressful practices (aeration, products with risks of phytotoxicity, products that cause damage when air temperatures are high) scheduled during especially stressful periods of time for the turf? Can you re-schedule the procedure and/or substitute gentler products?
- Can products that are scheduled for application at similar times be safely mixed in the spray tank?
- Are all label rates, state and federal regulations and recommendations being complied with?
- If you overseed, are products and practices timed to avoid any scheduling conflicts with renovation and overseeding procedures?

(i) Congratulations! You are done!

(ii) Your time and effort will pay off in improved planning, organization, coordination and communication.

<p>NOTE: When developing your insect, weed or disease plans, always consult the most current version of all product labels and confirm that your plan is within the manufacturer's labeled guidelines</p>

INSTRUCTIONS

Filling out the Budget Worksheet

What is the Budget Worksheet?

The Budget Worksheet is an electronic spreadsheet that is designed to help you:

- estimate and compare costs of pesticides, fertilizers and other products
- keep records of products applied, frequency and rates of application and total yearly costs

This worksheet is an optional tool that can be very helpful in selecting and comparing products and practices, but its use is not required to complete the template

Materials Needed

Computer: a computer equipped with Microsoft Excel

Forms: A blank **Budget Worksheet Form** (available as paper form for filling out by hand, or online, for electronic entry, at: <http://www.paceturf.org/ipm/>)

Examples: A **sample Budget Worksheet Form** that has already been completed is provided for guidance, and can be obtained online at <http://www.paceturf.org/ipm/>

Completed forms and worksheets: Completed **IPM Planner (optional)**

Instructions

- Column 1: Product. This information can be transferred from column 1 of your completed IPM Planner
 - Enter a product name and its formulation.
 - If appropriate, enter the code for the pest(s) that this product will target
 - example: Merit 75 WP (I 1, 2, 5)
- Column 2: Rate. This information can be transferred from column 2 of your completed IPM Planner
 - Enter the rate of product you plan to use
- Column 3: Rate units. This information can be transferred from column 3 of your completed IPM Planner
 - Use whichever units of measure apply – English or metric – to the product that you are applying.
 - Use abbreviations such as those below if space is limited:

oz = ounces	ml = milliliters
fl oz = fluid ounces	l = liters
qt = quarts	g = grams
gal = gallons	kg = kilograms

INSTRUCTIONS

Filling out the Budget Worksheet

- **Column 4:** Treated area. This information can be transferred from column 4 of your completed IPM Planner. Varying this number will allow you to see how increasing or decreasing the treated area will affect your costs.
 - Use whichever units of measure apply – English or metric – to the unit of area that your rate (column 2) is based on
 - Use abbreviations such as those below if space is limited:
M = 1,000 sq ft
A = acre
Ha = hectare
- **Column 5:** Number of applications to be made per year (column 5)*. This information can be obtained by counting the number of applications designated in your IPM Planner. Varying this number will allow you to see how increasing or decreasing application frequency can affect your costs.
- **Column 6:** Product Packaging. Enter the size of the container or package that the product will be purchased as. English or metric units can be used.
- **Column 7:** Cost per package. Enter the price quote for the package listed in column 6 (product packaging). Any form of currency can be used.
- **Column 8:** Rate units per package. Remember the rate units that you entered in column 3? All you have to do now is calculate the number of those rate units in the product package that you will be using. For example, if you are using Banner Maxx at 2 fluid oz/1000 sq ft, and the product is packaged in one-gallon (128 oz) packages, then the rate units per package = 128.
- **Column 9:** Area units to be treated. Calculate this by dividing the area that you want to treat by the treated area units (column 4). For example, if you want to treat 90,000 square feet, and your treated area units = 1,000 square feet, then you would enter the number 90 (90,000/1,000) in column 9.

Once the values in columns 1 – 9 are entered for each product, the spreadsheet will calculate the rest:

- how many applications you can get from one package for treating the targeted treatment area (column 10)
- the cost per application (column 11)
- the number of packages needed to cover the area and frequency of treatment desired (column 12)
- the total cost of each product for all planned applications on the targeted area (column 13)
- the total cost of all products listed (bottom right-hand corner of spreadsheet)

IMPORTANT: SAVE THIS DOCUMENT!! Go to Excel's "File" menu (upper left hand corner of your screen) and select "Save As". Give the document an appropriate name that includes the current date such as: 2010_0504_budget_worksheet.

INSTRUCTIONS

Filling out the Budget Worksheet

And remember, the budgeting worksheet has multiple uses. It can be an interim planning tool that helps you determine how much each potential product or practice will cost you. But it can also be a valuable record-keeping document that keeps track of all product applications, as well as their associated costs.

* Handy tip: If you would like to retain all of the information that you have entered for each product, but don't want the cost of the product added into the yearly total cost that is calculated at the bottom right of the spread sheet, simply enter a zero (0) in column 5 (number of applications to be made per year) for the product in question.

INSTRUCTIONS

Keeping your IPM Template “Green”

The IPM Template: A dynamic tool

The **IPM Plan** that you have just developed is a dynamic, living document that will reflect changes in weather, turf performance, budget constraints, and management expectations as the year progresses.

For this reason, it is very important to review, fine tune and update your IPM planner periodically (we suggest monthly), and to re-write it on a blank IPM Planner form when reality deviates significantly from your original predictions.