

# **PROBLEMS CAUSES CURES**

Designed to help you solve Hardwood Flooring Problems

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Wood Floors:

The Problem, The Cause and The Cure

Introduction:

This publication is prepared for your use by the National Wood Flooring Association to assist you in (1) identifying the problem that you encounter on a wood floor inspection, (2) what probably caused the problem, and (3) how to correct the problem. Experience indicates that a given floor may display more than one difficulty, and that several corrections will be required even though there may be only one cause. For this reason the inspector must be observant, note all details, listen to the parties involved for leads, hints, comments, and keep complete written notes and date them. Develop full history with dates about when delivered, installed, problem first noticed, any other changes, etc.

Our mission in writing is to help make inspections of problem floors easier and more accurate so that the ultimate owner of the floor will be pleased and satisfied with our industry's product. Your promptness and professionalism are required. We will address the more frequent problems. Should you encounter a condition not covered, call us.

## **IDENTIFICATION:**

To properly evaluate a floor, it is necessary to identify the product correctly. (Example: Surface job – applied coating is peeling off – is it a factory waxed pre-finished product?). Our industry produces a myriad of products, so make identification easy by asking the owner, the installer, the material source, etc. If this all fails, follow this checklist:

1. Is the flooring linear (long narrow boards) or parquet (squares).
2. Is the face of the flooring rotary-peeled (plywood) or sawn (solid)?
3. At a floor register opening, stair nosing, floor electric outlet, measure the thickness. Insert a probe to measure. Remove molding at a wall and measure thickness.
4. Can you see that the wood is solid or laminated (layered)? How many layers thick? If solid, is the surface color the same through the thickness?
5. Measure the width of the linear floor. If laminated, measure the length of the boards, or are they random?
6. Measure the length of the slats in parquet.
7. Are there bevels between linear boards? Are there bevels between the ends of linear boards?
8. Are there bevels in the parquet? What size are the squares?
9. With a probe inserted between sides and ends of linear, determine if there is a tongue. Same between parquet squares.
10. Determine species of wood if possible. White Oak is yellow/gray. Red Oak is pink/tan. Is all the wood the same, or is it mixed species.
11. Is the installation glued, nailed or floated over foam, a wood subfloor, a basement, another room, crawl space, or direct over concrete.
12. Note the color of the mastic used.
13. If linear and with pegs, measure the diameter of the pegs. Note peg placement in the boards. Are the pegs wood or plastic?
14. If you can remove a piece of the flooring, on linear note the hollowback and any mill markings. On parquet is there evidence of any backing and is the assembly done with steel, aluminum wire, or plastic.
15. How was the owner instructed to maintain the floor?
16. Moisture content of wood, substrate, moldings. Relative Humidity in airspace. Record and Date information. With all (or most) of this information, you will probably have identified the product involved. If not, contact your normal materials source for assistance or give us a call.

## **PROBLEM #1**

Cupping, or "washboard". Across the width of one piece of the flooring material, the edges are high, the center is lower. Generally develops gradually.

## **CAUSE:**

Moisture imbalance through the thickness is the only cause. The material was manufactured flat and was flat when installed. Job site or occupant provided moisture is greater on the bottom of the piece than on the top. Prove it with your moisture meter. Find the source of moisture and eliminate it. Common moisture sources and their corrections are:

Airborne (Relative Humidity) – dehumidify air space or (lack of during heating season – humidify air space); wet basement – ventilate, dehumidify; crawlspace – groundcover/vents, add exhaust fan on timer; lot topography – French drain to remove; rain handling provisions – correct to drain away from house; excessive lawn/garden moisture – reduce/waterproof foundation; leaks plumbing, roof, doors – fix; don't hose patio; maintenance; correct capillary through slab – install barrier, French drain, drain tiles. In kitchen, the dishwasher and icemaker are notorious leakers.

Expansion is also the result of site moisture and may have moved the floor tight to vertical surfaces. If so, remove flooring along the wall, or saw cut, to relieve pressure.

## **CURE:**

Allow time. Time for the corrections to take effect – to permit the floor to improve on its own. It may become acceptable (see problem #2). After stabilized, sand flat and finish. Cost of corrections should be for owner or builder to cover.

## **PROBLEM #2**

"Crowning", or the center of the piece of flooring (across its width) is high, the edges are lower.

### **CAUSE:**

While moisture imbalance might be the cause (by excessive moisture introduced on the finish side of the floor; i.e. water used in maintenance, plumbing leaks overhead sprinkler system), it is more likely that the floor was cupped (problem #1) and sanded flat thus removing the outer edges, the sanding having been done at the wrong time, i.e. before corrections were made and before the floor flattened on its own.

### **CURE:**

After the floor has stabilized following corrections, sand flat and finish.

Note: Some slight cup and/or crown can and should be tolerated. It is common in wood floors, especially in wider planks. It is, in many cases, seasonal in its occurrence and can be minimized with lighting and furniture placement, by using beveled products and by other than high gloss finish.

## **PROBLEM #3**

"Buckling", "tented", "ballooning" floors. Pieces of the flooring are no longer in contact with the substrate.

### **CAUSE:**

Generally an extreme moisture problem. See Problem #1 for sources and corrections. Inadequate expansion space, even "net fix" (installer error) prevents normal expansion. On nailed products, insufficient nailing, incorrect nails, incorrect subfloor construction. On glue down product, incorrect mastic, insufficient mastic, wrong trowel used, inadequate mastic transfer, subfloor separation, subfloor contamination.

### **CURE:**

If caught early, spot repair/replacement may be possible. In many cases, however, pull, correct, and relay/replace is more practical.

## **PROBLEM #4**

Normal cracks, separations between individual flooring pieces. Uniform and general through floor.

### **CAUSE:**

Mother Nature. Dryness. As moisture caused problems 1, 2, & 3, the loss of moisture results in the most frequent reason for shrinkage of individual pieces and cracks. Should a floor have been exposed to problems 1, 2 & 3, then afterwards, "dried out", cracks will develop. If subjected to extreme moisture, the edges of the wood (a vegetable made up of cells) can crush, and subsequent drying and shrinkage can present larger than normal cracks. Square edge (unbeveled) floors show cracks more than beveled. White, light, pastel finish show cracks more than darker wood-tone finished floors. Most cracks are seasonal – they show in dry months, or the cold season when heating is required, and close during humid periods. This type of separation and closing is considered normal. In solid 2" wide strip oak floors, dry time cracks may be the width of a dime's thickness (1/32"). Wider boards will have wider cracks (and the reverse is true).

### **CURE:**

Add moisture to the air space during dry periods. A constant Relative Humidity (RH) of 50% works in concert with the manufacture of wood floors to provide stability in the floor. Live with normal cracks or add humidity – it's the owners' choice. Easy ways – boil a pan of water on the stove, turn off bathroom exhaust fan, open dishwasher after rinse cycle, a pan of water in furnace fan compartment, hang laundry to dry in basement. Better yet, install humidifier to furnace controlled by a humidistat set at 50% RH. In dry and warm climates, add moisture (pan or humidifier) and run furnace "fan only".

### **PROBLEM #5**

Abnormal cracks – larger than normal, cluster or localized, end separation, not uniform and not general throughout, do not close up during humid months.

#### **CAUSE:**

Edge crush from prior exposure to extreme moisture, especially solid, flat grain flooring (and may be general throughout). If surface coated (such as polyurethane), edges of some adjacent pieces may be literally “glued” together, or panelized, and shrinkage cracks multiplied at the weakest points. (See note that follows) “Hot Spots” in the undersurface such as poorly insulated heating ducts, hot water plumbing lines, radiant heating system (if so, should be laminated products only), the new “Instant Hot Water” feature, register openings, heat from refrigerator motor, check nail spacing with stud finder. With adhesive applied floors, early foot traffic, incorrect adhesive, amount transferred or used (most noticed in traffic pattern).

  ” thick solid parquet with no return control (cork) in expansion space, generally indicated by center of the field is tight, with gaps around the walls. Note if there is a pattern to the cracks, such as 4’ x 4’ or 4’ x 8’ indicating subfloor changes or weakness. Glued over sheet vinyl may show 6’ cracks from shrinkage or loose vinyl. Does the pattern of cracks convey a relationship with foundation or slab cracks and/or settlement. Check nail spacing on solid products take wood moisture content reading and if it is within normal range for your market and the wood is undersize, drying was improper prior to manufacture. If wood MC is normal and wood is “on size” or over, the wood was wet prior to installation.

#### **CURE:**

In addition to obvious corrections suggested under “cause” (i.e., add insulation between heat ducts and subfloor for “hotspots”, pull, add adhesives, relay, adjust    parquet, add expansion joint control, add cross bracing under weak subfloor), attempt to elevate the relative humidity in the air space and after sufficient time has passed to confirm that the problem has stabilized, fill the cracks with the appropriate color-matched fill. Re-coat if necessary. Last resort, pull and replace – note however, that if corrections are not made, chances are that replacement will develop the same problem.

NOTE: When a floor shows “panelizing” and a surface coat has been used, you might choose to sand then finish with seal and wax, or if surface finish is required, use a sealer first rather than the stronger finish directly on the new floor.

### **PROBLEM #6**

Quality or “Grade” – knots, heavy color variation, out-of-square, surface defects.

#### **CAUSE:**

Consumer expectations, incorrect sampling, incorrect ordering, mistake by supplier, manufacturer, installer error (should not have installed).

#### **CURE:**

Pull and replace offending pieces. Review samples with owner.

### **PROBLEM #7**

Excessive and Early wear on finish – scratches, traffic pattern.

#### **CAUSE:**

Improper maintenance, grit, water, strong soaps, dog toenails, chair legs.

#### **CURE:**

Correct maintenance, especially vacuum, not just broom sweep. Clip dog’s nails, felt chair leg glides, appropriate exterior walk-off mats to prevent grit, area rugs especially in from of kitchen sinks. Re-coat if necessary – owner pays.

**PROBLEM #8**

Loose, noisy, squeaky floor

**CAUSE:**

Inadequate nailing, flexing weak subfloor system, nailed over particleboard type subfloor. Check subfloor thickness and joist direction. Insufficient or incorrect adhesive. Subjected to excess moisture, excessive drying.

**CURE:**

Add face nails, counter-sink & putty. Strengthen subfloor from below. Inject adhesive or pull-add-relay. Lubricate squeaks with graphite, wax, baby powder. Wedge subfloor up from joists.

**PROBLEM #9**

Color – not right, changed

**CAUSE:**

Customer expectation, poor sampling, lighting over the floor and room colorings. Incorrect maintenance including residue of cleaners, waxes, etc. Wood itself changes color with age ("Patina"). Extreme hot sunlight through South/West facing windows. Color different under rugs or low furniture from lack of exposure. Bleaching is unpredictable – don't oversell expected results.

**CURE:**

Compare with sample. Explain lighting and colors. Remove residue and correct maintenance procedures. Move rugs and colors will even out in time. Shade large windows.

**PROBLEM #10**

Dents – Yes, wood dents.

**CAUSE:**

High heels. Dropped heavy objects, metal tips on furniture legs. Unprotected rolling of heavy castered appliances such as refrigerator or freezer.

**CURE:**

Remove high heels or maintain proper heel-tip protectors. Provide large felt or rubber protectors under heavy furniture legs. Roll heavy casters over plywood protection only. For individual dents where wood fibers are not broken, cover with a dampened cloth and press with an electric iron to draw fibers up. Last resort sand and finish – owner pays.

**PROBLEM #11**

Stains/discoloration

**CAUSE:**

Water from spills, water from continual source leading to mildew (black) or decay (brown/white) or alkali (white) or bleeding up of adhesive. Urine (dark) from pets, wet diapers. Unprotected metal chair legs. Improper maintenance with water or harsh chemicals. Traffic pattern wear. Excessive harsh sunlight (wood looks starved near South or West facing windows). Light deprivation under area rugs, large low furniture. Be sure to observe if only one piece of flooring is affected, or does the stain continue across adjacent pieces.

**CURE:**

Correct water source, let dry. Minimize sunlight. Relocate area rugs. Correct maintenance procedures and products...Dark stains, lightly abraid surface with fine sandpaper, feather out area, dampen cloth with 50/50 household bleach & water and lay on stain for 30 minutes, remove, let dry, re-color if necessary. Waxed floors, clean with renovator or paint thinner (combustible) and re-wax. Whiteness/cloudy surface finish, clean and buff. If all fails, screen and coat, sand and refinish, replace severe boards.

**PROBLEM #12**

Slivers, Splinters

**CAUSE:**

Unevenness caused by expansion, cup, sub-floor irregularities, edge crushing from expansion, grain raise from moisture or water maintenance. Damage during installation (associated with nailing – prove with stud finder or magnet). Wind Shake, associated with annual rings only – springwood fracture. Beveled prefinished products. Wirebrushed products.

**CURE:**

If new floor is producing “fibers” not splinters (especially prefinished and wirebrushed, buff vigorously with commercial electric buffer and nylon polishing pad (accelerate the “break in” period). Slivered bevels, shave with razor knife, re-stain. Expansion, cup, grain raise – correct moisture source. Cut splinters away with razor knife at sound thick end, fill and finish. Wind Shake – if one or a few pieces – remove and replace - if numerous , sand and surface finish. Replace entire floor and contact the manufacturer.

**PROBLEM #13**

Finish Peeling – bubbles, blister

**CAUSE:**

Stain not dry. Excessive burnishing. Early coats not dry. Skipped screening between coats. Product incompatibility. Stain not sufficiently wiped leaving heavy pigment on surface (is finish peeling from finish or wood?), improper tack. Surface contaminated such as wax, or other maintenance product.

**CURE:**

If de-lamination from wood surface, sand and refinish. If surface only, screen and re-coat.

**PROBLEM #14**

Roughness

**CAUSE:**

Moisture from maintenance, spills, constant source, condensation causing surface grain raise. Poor sanding, edging, scraping. Contamination in finish during dry time.

**CURE:**

Correct moisture source. Lightly sand or screen. Re-coat.

**PROBLEM #15**

“Shell Out” of Springwood – uneven wear between segments of annual ring.

**CAUSE:**

Heavy traffic, repeated sliding of heavy furniture, hard casters, water in maintenance. Especially seen in laminated or peeled face products under desks with foot shuffle and caster wear.

**CURE:**

Sand and refinish with surface protection. Use desk mat chair protector. Change casters to wide non-marking gray rubber.

**PROBLEM #16**

Unevenness – Whole floor, not individual pieces.

**CAUSE:**

Wood joist system – subfloor warped and loose, joists warped or fractured, support pillars settled, perimeter foundation settlement.

Concrete slab system – slab cracked and settled.

**CURE:**

Correct, strengthen substructure, repair subfloor, splice joists, add joists. Structural, failure is not the wood floor contractors domain usually. Owner needs a general contractor for repairs prior to wood floor corrections.

**PROBLEM #17**

Gloss levels uneven in finish

**CAUSE:**

Insufficient mixing of finish prior to application, dirty contaminated applicator, uneven finish thickness, uneven sanding, uneven lighting illusion.

**CURE:**

Screen and re-coat. Illusion – view at different time of day, different lighting.

**PROBLEM #18**

Insects

**CAUSE:**

Termites, identified by eating corridors beneath surface which when weakened, the fragile surface sags. The bugs are white or cream colored. Subterranean type build sand tubes. Powderpost Beetles identified by 1/16" diameter perfect circle hole in surface of floor. Active infestation will show clean bright wood in holes with fine talcum powder like dust piles around the holes. Inactive holes are darkened, even show stain or finish on walls of the hole. When in doubt, collect sample bugs; consult exterminator, entomologist, or extension service, etc.

**CURE:**

Structure must first be rid of active termites by professional exterminator. Repair structural damage. Pull and replace damaged floorboards, sand and refinish. Heavy infestation of Powderpost Beetle, handle as above. When Powderpost is occasional, few boards especially in new floors, treat individual openings immediately with insecticide (from hardware or garden shop) injected by syringe into hole, or aerosol insect spray through a straw. Usually will not disturb finish. Have owner watch for new evidence (dust piles) and treat again. After 2-3 months holes may be filled. Termites will not be associated with the flooring and costs will be the responsibility of the owner. Powderpost may be in new flooring materials. Immediately on first report notify your floor supplier. Prompt action by all will minimize costs involved. Check all surroundings for infected wood molding, furniture (especially bamboo and antiques). If old infestation is in other materials the owner must stand the costs involved in floor repairs.

**PROBLEM #19**

Maple with cross-grained brown marks

**CAUSE:**

"Sticker burn", a discoloration caused by "weathering" of the rough sawn maple lumber on stacking strips during the air drying period. Occurs across the width of strips, each mark \_ to 1" wide, and about every 20" to 24" down the length of individual strips. Will not sand out.

**CURE:**

Don't install if marks will be a defect to the owner. Sticker burn is allowed in Second Grade maple, not allowed in First Grade. Clear waterborne finish will show burn more than ambering finish.

**PROBLEM #20**

Flooded Floors

**CAUSE:**

Standing water – a little or a lot.

**CURE:**

Immediate action to stop source, remove surface water, drain water from below if possible (drill subfloor) and elevate temperature, increase air flow (fans) to initiate immediately a drying environment. Dry from below in basement houses. Exhaust fans in crawl space homes. And wait. Make no repairs until moisture meter reading (top and bottom) is at the usual level for your area. If flooding was of long duration on surface finish floor, rough sanding removing the finish will accelerate drying.

When flooring is "stabilized" – not before!

1. If flat, fill if necessary, screen and re-coat or re-wax.
2. If cupped, sand flat, fill and finish.
3. If "tented", loose from subfloor, repair areas or replace entirely.

Note that when floor construction is "plywood over concrete" as the subfloor, it is unlikely that the plywood will dry out, or the concrete below will dry out in any reasonable time and to a safe level for reinstallation or repair. Full removal to concrete is usually best, allowing the slab to dry, then replace.

One further note: Usually an insurance repair is involved with both an unknowledgeable agent or inspector/adjustor, and the owner pushing for a "quick-fix". Don't succumb to their pressure. Walk away from the job. Or get a full release for future responsibility.

**PROBLEM #21**

**THE VACANT HOUSE – "Greenhouse Effect"**

**CAUSE:**

Security conscious vacationers, a homebuilder's unsold inventory, whenever a wood floor is deprived of an airflow in the environment, it can and will misbehave. Sunlight through windows generates heat, lowers humidity, moisture vapor enters to balance, nights cool off, humidity builds and wood floors cup. Thermostats set at 60 degrees and outside, winter howls, heating system runs constantly with no moisture added, and floors shrink

**CURE:**

Avoid problems by leaving windows "ajar", have neighbor air the house out occasionally. Treat floors as discussed under cupped, tented, or shrinkage cracks – and only after environment returns to normal. Owner to pay.

**APPENDIX****Tool and Equipment required for inspections:**

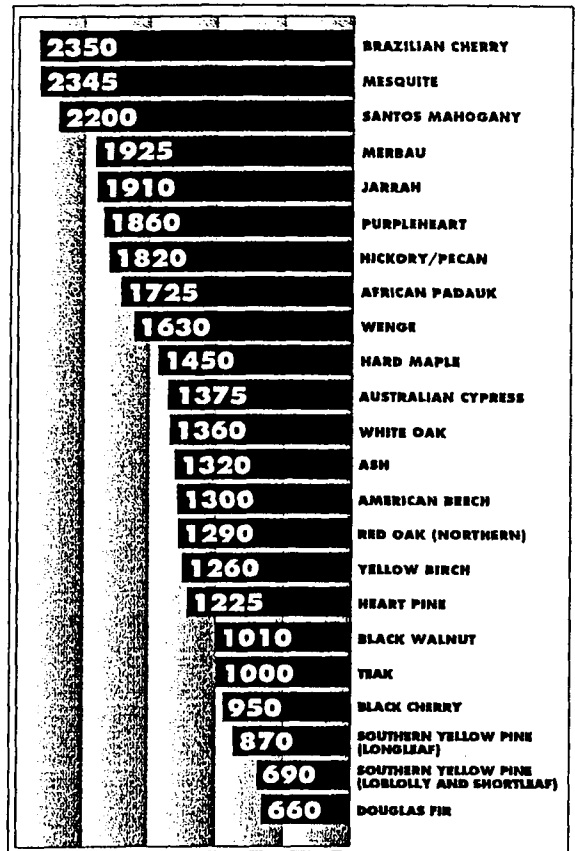
Moisture meter (with \_" pins) calibrated for wood  
Moisture meter (with 1 1/8" insulated pins), calibrated for wood  
Sling psychrometer, or other for relative humidity  
Tape measure  
Pocket knife  
Flashlight  
Magnetic Stud Finder  
Hammer  
Blade Screwdriver  
Phillips Screwdriver  
1" Wood Chisel  
Selection of 4d to 8d Finish Nails  
Thin "feeler gauge"

## RELATIVE HARDNESS OF SELECTED WOOD FLOORING SPECIES

(Ranked by Janka hardness rating)

The Janka (or side) hardness test measures the force required to embed a .444-inch steel ball to half its diameter in wood. It is one of the best measures of the ability of a wood species to withstand denting and wear. By the same token, it is also a good indicator of how hard or easy a species is to saw or nail. Northern red oak, for example, has a Janka hardness rating of 1290. Brazilian cherry, with a rating of 2350, is nearly twice as hard. If you're accustomed to working with red oak and decide to tackle a job with Brazilian cherry, you can expect it to be much harder to cut and nail.

- Source: Hardness ratings for most species taken from Wood Handbook: Wood as an Engineering Material (Agriculture Handbook 72, Forest Products Laboratory, Forest Service, U.S. Department of Agriculture; revised 1987), except for Australian cypress, wenge, African padauk, merbau and Santos mahogany, which were provided by International Hardwood Flooring; heart pine by Mountain Lumber, and mesquite by Mesquite Products of Texas.
- Douglas fir rating is an average of ratings for Coast, Interior West and Interior North species.



## RELATIVE STABILITY OF SELECTED WOOD FLOORING SPECIES

(Ranked by dimensional change coefficient)

The numbers in the chart reflect the dimensional change coefficient for the various species, measured as tangential shrinkage or swelling within normal moisture content limits of 6-14 percent. Tangential change values will normally reflect changes in plainsawn wood. Quartersawn wood will usually be more dimensionally stable than plainsawn.

The dimensional change coefficient can be used to calculate expected shrinkage or swelling. Simply multiply the change in moisture content by the change coefficient, then multiply by the width of the board.

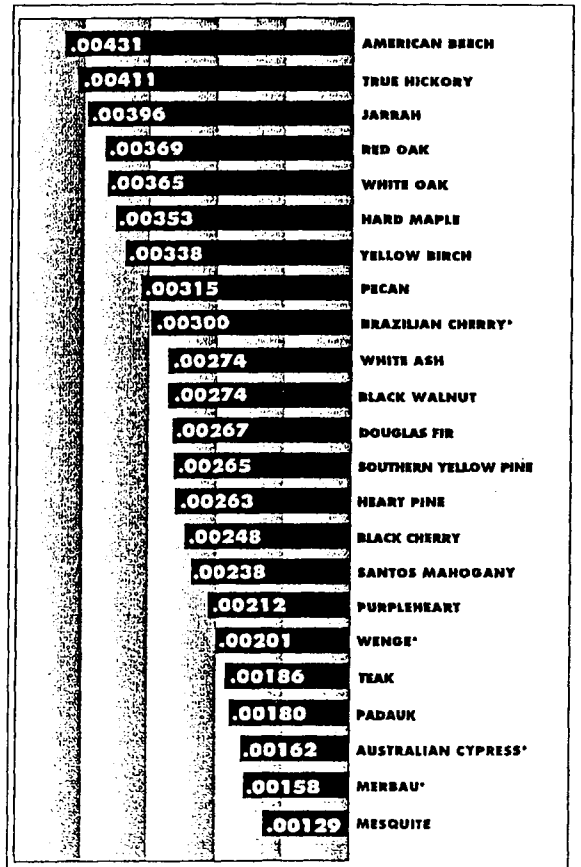
Example: A mesquite (change coefficient = .00129) board 5 inches wide experiences a moisture content change from 6 to 9 percent — a change of 3 percentage points.

Calculation:  $3 \times .00129 = .00387 \times 5 = .019$  inches.

In actual practice, however, change would be diminished in a complete floor, as the boards' proximity to each other tends to restrain movement.

The chart is best used for comparison.

\* Although some tropical woods such as Australian cypress, Brazilian cherry, merbau and wenge appear in this chart to have excellent moisture stability compared to domestic oak, actual installations of many of these woods have demonstrated significant movement in use. To avoid problems later, extra care should be taken to inform potential users of these tendencies prior to purchase.



• Source: Stability ratings taken from Wood Handbook: Wood as an Engineering Material (Agriculture Handbook 72, Forest Products Laboratory, Forest Service, U.S. Department of Agriculture; revised 1987).