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A GUIDE TO HOPEFUL CREATION CARE



Calvin B. DeWitt

Foreword by Joel C. Hunter

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Grand Rapids, Michigan

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epigraph

The earth was given to man, with this condition, that he should occupy himself in its cultivation. . . . The custody of the garden was given in charge to Adam, to show that we possess the things which God has committed to our hands, on the condition that, being content with the frugal and moderate use of them, we should take care of what shall remain. Let him who possesses a field, so partake of its yearly fruits, that he may not suffer the ground to be injured by his negligence, but let him endeavor to hand it down to posterity as he received it, or even better cultivated. Let him so feed on its fruits, that he neither dissipates it by luxury, nor permits it to be marred or ruined by neglect. Moreover, that this economy, and this diligence, with respect to those good things which God has given us to enjoy, may flourish among us; let everyone regard himself as the steward of God in all things which he possesses. Then he will neither conduct himself dissolutely, nor corrupt by abuse those things which God requires to be preserved.

—John Calvin on Genesis 2:15;
Commentary on Genesis, 1554

foreword

Though he probably has not known this, Calvin DeWitt has been my mentor. I have wanted to make a difference with my life. I have wanted to make a servant's impact for God upon all his creation. And for that I have needed great teachers.

Cal DeWitt has everything to recommend him as a great teacher. He has advanced training in the sciences of which he speaks. He has studied Scripture with his heart and soul as well as his mind. Cal is also respected highly by his peers. He is a cofounder of the leading evangelical network on the environment (Evangelical Environmental Network), and he was the founding director of an institute for environmental studies (Au Sable Institute). Cal is personally intrigued and delighted by God's creation—and has been so from his boyhood. His students revere him not only for his knowledge but also for his integrity. And, besides all that, Cal's work is fun to read.

That's what else I needed: a good textbook. I entered into the advocacy of creation care through the recommendation of other evangelical leaders. I did not know much about the field, but I love to study. I am a pastor, so I was not reading just for me but also for thousands who listen to me. Therefore, I had to be very careful about my reference material. Dr. DeWitt to my rescue! I read *Earthwise* as one of my resource books, and I thought, "How could I have missed this as an important part of following and worshipping God?"

I challenge you to learn from Cal DeWitt (with me), and we will benefit others together. The care of God's creation is not just a way to honor the Creator, although it is that. The care of God's creation is not just a way to love your neighbor (and grandchildren) as you love yourself, although it is that too. The care of God's creation is not just another way to obey God's command to cultivate and keep the earth, though it is also that too. The care of

creation is a crucial issue. The way we address it could mean life or death for millions of people around the world. We can help protect those least able to cope with environmental degradation. They are among the “least of these” whom Jesus specifically taught about in Matthew 25.

So this is more than a textbook, and Cal DeWitt is more than a teacher. This is a book of life and a book of love. This is a book that will make your life count more for the benefit of others. This is a book that will help you love the natural world that fascinated you as a child. This is a book that will help you love your neighbor in a practical way.

Read this book and you will be different. So will the world.

—Dr. Joel C. Hunter, Senior Pastor, Northland
Community Church, Orlando, Florida, 2007

Editor's note: This Foreword first appeared in the second edition of *Earthwise*. A member of the United States President's Advisory Council on Faith-Based and Neighborhood Partnerships and of the board of directors of the National Association of Evangelicals, Joel Hunter has helped raise awareness of environmental concerns through his work for the Evangelical Climate Initiative, through preaching and speaking engagements and media interviews, and in his book *A New Kind of Conservative* (Regal Books, 2008).

using this book

Author's Preface to the Third Edition

Living in harmony with creation and sharing the deep joy of such living is the theme of this book—and this objective is for anyone and everyone, for we are all part of the earth and the environment we live in. In this new edition of *Earthwise* I am writing not only for people of the Christian faith but for all who wish to understand something of the roots of environmental responsibility and care.

As indicated by John Bascom (1879), an early president of the University of Wisconsin, where I teach, “Christianity has expended many hundred years in incorporating into society” many sentiments that are not soon lost, even “if Christianity is rejected.” And among those “sentiments” is Christianity’s “stewardship tradition,” a major gift to the world. I hope that in engaging with this book my readers who are not of the Christian faith will not be offended by the Christian language I use, but instead may recognize an opportunity to discover how the environment can be seen through the eyes of Christian faith. I greatly appreciate their tolerance, if not appreciation, of a perspective that may differ from that of their own background or tradition.

In the first two editions of this book, I wrote to try to inspire discussion groups in Christian churches, household gatherings, and classes in schools and colleges, urging people to action. Much has happened in the nearly twenty years since publication of the first edition, not only in our understanding of the way the world works and of our human impact on the environment, but also in Christianity as it increasingly rediscovers itself as “a religion and philosophy of creation” (Clarence J. Glacken, 1967). Beyond this rediscovery is a growing appreciation of the influence of Christianity in producing leading “environmentalists” such as George Perkins Marsh, John Muir, Teddy Roosevelt, and Rachel Carson, two of whom memorized the New Testament before they were

teenagers. Not too surprisingly, we also have found that ecology—the study of organisms in relationship with their environment—has deep Christian roots.

HOW MIGHT YOU BENEFIT?

In all three editions of this book, I have written not only from my grounding in the natural sciences that came largely from the education and training I received as a scientist, but also from the heritage of my childhood and youth. I know that my heritage is responsible for my becoming a scientist and, more, for becoming a person who continually seeks to develop and sustain a holistic and integrative worldview—a worldview that accords with the way the world works. In this, I embrace not only the pursuit of scientific understanding but also questions regarding “what ought to be” in human life and action and “what we then ought to do” in our life and work. My deepest interest is to achieve as comprehensive and coherent an understanding of how the world works as possible, and in this context to live in harmony with creation and to share the inspiring joy of such living. In pursuing this interest, I am impatient with unscientific methods and speculations, and I continue to work at being fully grounded in what I learn, know, and believe from scholarly colleagues past and present in science and theology, in order to work from the best possible base of knowledge and understanding, within my gifts and capacities, to know who I am and to learn my role in society and creation.

In my journey into science, accompanied and nurtured by my heritage, I am indebted to the upholding Christian community in which I was raised. I know that people have questioned heritages such as mine, that others have abandoned them, and that even more hold wholly different beliefs or nonbeliefs. But all of us know and appreciate that each of us was born and raised at a place and time over which we had no control. None of us is responsible (or can take credit) for his or her own particular heritage.

So I find myself asking, “How might you, with your particular heritage, benefit from reading *Earthwise*, stemming as it does from my particular heritage?”

First, if you share the same or a similar heritage, I expect that you might be inspired to be a faithful steward of creation. Or if your heritage is different from mine, you may find *Earthwise* helpful in understanding the contributions that biblical and

theological study bring to environmentalism and ecology, and you may find that exercise helpful in your conversations with people of Christian faith. In addition, if your heritage is Christian and yet has had little to say about God's creation or care for it, I hope you will be uplifted to find that together in *Earthwise* we (re)discover many of the biblical teachings that make up Christianity's "stewardship tradition."

I also realize that you might be reading *Earthwise* as an individual, a member of a study group, or as a member of a college or university class. In that regard I hope that in this book you will find helpful the ideas and suggestions that come from my experience in teaching and learning.

REFLECTIVE JOURNAL

As you engage with *Earthwise* and use it as a primer for thinking and action, I strongly suggest that you obtain a bound journal with blank pages into which you can enter your thoughts, observations, and reflective thinking. Then you can write, in your own style, a collection of "letters to yourself" reflecting on experiences, observations, and ideas that come to mind from reading and reflecting on *Earthwise* and from related matters in your daily life. This might include reflections you have gathered from radio, television, lectures, or sermons; or from a walk or hike, during your travel through town or across the landscape; or from observing or working in a garden; or through discussion or debate with a friend or antagonist. You can keep your reflections to yourself, of course, but you might also enjoy sharing some of your thoughts with others, particularly when they might have something to share with you from their own reflective journals.

INTEGRATIVE NOTEBOOK

Earthwise is a primer, not a "last word," so you might like to do as thousands of my students have done: prepare your own loose-leaf book that helps you build on what you read and study here—and then continue, through the months and years ahead, to assemble and organize materials into an integrated whole. I suggest obtaining a three-ring binder in which you can gather and organize materials on environmental understanding, environmental practice, and creation care. Aim for a careful and meaningful integration of things that inform and inspire you, things you have done,

and things you hope to do. Your materials could include brochures, articles, sketches, photos, diagrams, and more.

As you begin, simply insert materials in any order that seems best to you. Then later you may want to reorganize the contents along lines that begin to shape an integrative framework. As the weeks pass, you could consider ways in which reorganization could continue to achieve an ever better integration of readings, thoughts, experiences, and personal practices.

I also suggest that, in time, you open your notebook to others to allow them to make comments and suggestions, and to inspire them to evaluate how you are doing. You can leave your notebook “lying around” on a coffee table or countertop so that friends and guests feel free to open it. It might contain a log of activities, sheets on animals and plants observed, reprints and pages from magazines and newspapers, records of plantings in your garden and of trees and shrubs in your yard, photocopies, and computer printouts. And of course you can organize your notebook again and again. You can use dividers with index tabs and removable labels to help you organize information. At some point you might also want to fit the volume with an attractive cover and a title page that includes your name. A table of contents and a preface describing its origin and purpose can also be helpful. Be as creative as you wish!

TEACHING AND LEARNING CLUB

You might also like to link with four or five other people to study *Earthwise*—and perhaps to share readings from your reflective journals, or to exchange ideas and materials for your three-ring notebooks. See also “A Short Course in Environmental Science” in the Appendix of this book.

When I’m part of a teaching and learning club, I like to find a convenient, friendly corner in a coffee shop to get together regularly. This can be tremendous fun; give it a try! And when you get to the mini-workshop in chapter 5 of this book, your teaching and learning club might just want to become the group that works to implement the results of the workshop in your community, neighborhood, congregation, school, or other group.

SHARING THE JOY OF HARMONIOUS LIVING

When you reach a point in your study of *Earthwise* at which you ask, “What can I do? What must I do?”—then you no doubt will also take action to live in harmony with creation. Beyond “doing something” personally, there is also the invigorating work of sharing with others the joy of such living. After all, caring for creation and enjoying life lived in harmony with the way the world works should not be kept to ourselves!

So you will want to ask, “Where are the opportunities? Where are the openings? What are the possibilities?” What might you do, how might you participate, in bringing good news and good practice to every creature? You will not only want to discover or refresh your passion for creation care; you will also want to “put wheels under” that passion!

As you do, may you also grow in realizing the joyful results of praying, “Your kingdom come, your will be done, on earth . . .” (Matt. 6:10)!

introduction

I have been in love with the Creator since my childhood and have been inspired and awed by God’s creation for well over half a century. I gained an early appreciation for God’s creatures from caring for and keeping animals in the backyard zoo of my childhood and youth.

I am a teacher, and I love to teach about the wonders of the beautiful life that envelops the earth. From my first teaching assignment at age 16—a course in herpetology for young people at the Grand Rapids (Mich.) Public Museum—I went on to teach thousands of college and university students (and nearly every other person I’ve ever met), helping them to develop a sense of awe and wonder for God’s world. Like the great Teacher—my model—I too like to teach on field trips! And I am a continuous student, learning from the “university of creation” and from God’s holy Word.

One Sunday evening when I was in my teens, I overheard my uncle ask my dad a question about me: “Shouldn’t you help Cal do something more important than this—something that will help him get a job?” My dad was guiding him down the basement stairs to see my birds and fish while my mom and aunt prepared after-church coffee and goodies in the kitchen above. As they approached the door to my aviary and aquaria, I heard my dad softly reply that he thought I was doing just fine. You see, my dad had told me earlier to keep doing what I loved to do; that would mean I would do it very well—and that meant eventually someone would even pay me for it. In this—his rendition of Matthew 6:33—he proved to be ever so right! I now get paid for what I love to do. My profession is caring for God’s creation and helping others to do so.

From the subtitle, *A Guide to Hopeful Creation Care*, it would seem reasonable to conclude that this book is rooted in care for the natural environment and ecology. But my own vocation—and “where I’m coming from”—stems from a time long before anyone

heard or taught much about “the environment” or “environmentalism.” So while this book is a response to environmental issues of today, its *root*—and the *root* of my vocation—is in my delight in God’s creation. My motivation is summed up pretty well by Psalm 111:2: “Great are the works of the LORD; they are pondered by all who delight in them.” What a wonderful world God has given us! It’s a world so convicting of God’s divinity and everlasting power that everyone is without an excuse for not knowing something about God from his delightful creation (Rom. 1:20). Our delight calls for our study, our seeking out, and our full investigation of this marvelous creation!

This book aims both to lighten the load we carry and to urge us to joyful, redeeming action in and with God’s amazing world. It will not pile on guilt. God knows that we, along with the rest of humanity, are guilty, “for all have sinned and fall short of the glory of God” (Rom. 3:23). But ours is not to grovel in polluted gutters or to wring our hands over our sins. Instead, we are called to go about reclaiming creation for our Lord, knowing that “the earth is the LORD’s, and everything in it” (Ps. 24:1) and that we may eagerly do so out of joyful gratitude for God’s great gift of salvation.

Even as we begin, we are uplifted by the knowledge of God’s rule, of God’s loving gift of Jesus—through whom the world was made and in whom “all things hold together” (Col. 1:17). Jesus Christ is the one given by God to reconcile all things to himself (Col. 1:20). We know he is the one we must follow. Jesus is our best example of practicing dominion and stewardship.

So let’s join together not only to explore the dark recesses of creation’s degradations but also to resurface into the Bible’s teachings on creation’s care and keeping—and then to ascend into the joyful stewardship of the faithful children of God!

—Calvin B. (“Cal”) DeWitt



Seven Provisions for Creation¹

I was born and raised in the city of Grand Rapids, Michigan, and for nearly forty years now I have inhabited the great Waubesa Marsh in Wisconsin.

In many ways it is easier to learn of the workings of God's creation in this wetland ecosystem, but the city of my youth also provided a wonderful place to learn creation's lessons. With my brother and sister I felt the drifting wetness of torrential rains and gentle drizzles as we swung on a suspended canvas swing in the shelter of our front porch. One day a tornado's immense funnel cloud roared menacingly over the roof of the nearby Baxter Laundry. On summer evenings we heard the noisy "zzbrrraaaaaaaaaaannngggg!" of nighthawks breaking the silence of the night sky as they pulled out of their dramatic plunging dives. We also watched bats zig-zagging in flight around our corner streetlight, keeping insects in check. And then there was Mrs. Lockhart's Dutchman's pipe—a climbing vine with heart-shaped leaves—on which pipevine swallowtail caterpillars ate away with her reluctant approval. These caterpillars eventually

¹A full treatment of the provisions of the biosphere, in addition to a description of environmental abuses and needed response, can be found in Richard T. Wright and Bernard J. Nebel, *Environmental Science: Toward a Sustainable Future*, 10th edition (Englewood Cliffs, N.J.: Prentice-Hall, 2007).

transformed into magnificent butterflies that fluttered around the neighborhood or flopped around as they emerged as captives in my mother's canning jars. Better still were my bike rides to the dump at the edge of town and into the countryside, where I could find frogs, salamanders, snakes, and turtles. I brought home many of these treasures to my backyard zoo where I could study them for hours and days on end.

There was no question in my mind about the reason for all this wonderful life. What I was learning from these beautiful creatures was fully consistent with what I was hearing from sermons in church and from lessons at Baldwin Christian School. All these were God's creatures, works of the Master, the Creator in whom all creatures great and small—his Master-pieces—lived and moved and had their being. They were among the ones we sang about each Sunday: "Praise God . . . all creatures here below"!

Day after day this world opened new lessons about God's creatures and presented new things for which to give God praise. The psalms I sang in church beautifully complemented what I was learning in creation. Remember how Psalm 148 goes, for example? This is the way we sang it:

Hallelujah, praise Jehovah,
From the heavens praise His Name;
Praise Jehovah in the highest,
All His angels, praise proclaim.
All His hosts, together praise Him,
Sun and moon and stars on high;
Praise Him, O ye heavens of heavens,
And ye floods above the sky.

And then, in the next stanza:

Let them praises give Jehovah,
They were made at His command;
Them forever He established,
His decree shall ever stand.
From the earth, O praise Jehovah,
All ye seas, ye monsters all,
Fire and hail and snow and vapors,
Stormy winds that hear His call.

Then we burst forth with everything we had as we sang of trees, frogs, turtles, elephants, Holsteins, Jerseys, birds, kings, and relatives and neighbors:

All ye fruitful trees and cedars,
All ye hills and mountains high,
Creeping things and beasts and cattle,
Birds that in the heavens fly,
Kings of earth, and all ye people,
Princes great, earth's judges all;
Praise His Name, young men and maidens,
Aged men and children small.

Let them praises give Jehovah
For His Name alone is high,
And His glory is exalted,
 And His glory is exalted,
 And His glory is exalted,
Far above the earth and sky.

—Psalter Hymnal, 1959, 1976; 304

Years later on Sunday evenings when friends and neighbors from around our marsh and the nearby city of Madison came together, we often sang that very song. And when we followed our singing with a walk through this wetland, a neighbor shouted, “Birds that in the heavens fly!”

All creation praises God. Of this I am fully convinced. But beyond that, all creation breaks forth with a marvelous testimony—one so powerful that it leaves everyone without excuse for knowing something of God's everlasting power and lordship over all things. I remember in my youth savoring Article 2 of the Belgic Confession because it affirmed, in a deep theological way, the worth of my continuous observation and study of animals and plants in the city, the dump, and the outlying countryside:

Article 2: The Means by Which We Know God

We know him by two means:

First, by the creation, preservation, and government of the universe,

since that universe is before our eyes
like a beautiful book
 in which all creatures,
 great and small,
 are as letters
 to make us ponder
 the invisible things of God:
 his eternal power
 and his divinity,
 as the apostle Paul says in Romans 1:20.

All these things are enough to convict men
and to leave them without excuse.

Second, he makes himself known to us more
openly
by his holy and divine Word,
as much as we need in this life,
 for his glory
 and for the salvation of his own.

I knew from this marvelous confession that reading and study of the Bible in my home, school, and church was very important. And—wonderfully!—this confession also affirmed the importance of reading and studying the “beautiful book” of God’s creation.

Today the heavens continue to tell the glory of God, and earth’s creatures continue to pour forth their testimony to God’s eternal power and divine majesty (Ps. 19:1-4).

In early spring Waubesa Marsh bursts forth with extravagant abundance of life. Geese arrive, and soon afterward sandhill cranes wing down, announcing with their clangoring calls the arrival and revival of life on the great marsh.

Why such praise? Why such splendor and rebirth in spring-time? A joyful reading of Psalm 104 helps provide the answer. This psalm celebrates God as the great Provider and masterful Creator. God’s provisions for life and breath are everywhere evident. God’s provisions are so numerous and interwoven with each other that we cannot begin to give them their proper due.

Yet it is vitally important for us to put these provisions of our Creator into perspective. Bringing all this in through our

senses and incorporating it into our mind's eye helps us see more clearly God's "eternal power and divine nature" (Rom. 1:20). And through our study we grow to pour more meaning into our singing of doxologies, as in "Praise God . . . all creatures here below" and "Gloria in excelsis Deo."

Many of us have had awesome experiences in God's creation. Perhaps we have stood at the edge of a great canyon, or at the feet of giant trees in an ancient forest, or in the eye of a great storm. Perhaps we've enjoyed a flowering meadow as the morning mists lifted quietly, and we found ourselves humming "How Great Thou Art." How I wish we could walk together now to a place that would bring forth that song; it would put us into the right frame of mind for understanding God's provisions for creation. Let's open our minds now to the awesome wonder of our Lord's creation!

If at this moment you can put yourself in an environment that calls forth praise to God—do so! Maybe you have a creation-celebrating psalm or recording at your fingertips, or an inspiring view outside your window or in the yard, some flowers on a windowsill, or an open window to let in fresh air. At the very least, shift your position and put your mind in a mood for bringing God praise.

SEVEN PROVISIONS OF THE CREATOR

Let's reflect on seven of God's magnificent provisions for creation. These provisions—many of which are celebrated in Psalm 104—tell something of the remarkable integrity and beauty that have engendered awe, wonder, and respect for the Creator and creation through the ages.

1. Earth's Energy Exchange with the Sun and Space

Our star, the sun, radiates immense energy in all directions, heating whatever is in the path of its rays. This great thermonuclear energy source—the star that brightens earthly life—is a great empowering provision of God's love. It energizes nearly everything we know on earth: green plants and all creatures that eat them, great flows of water and air across the globe, movement of automobiles and aircraft, heating for homes and factories.

Our earth also radiates energy, emitting not visible light but invisible infrared "light"—radiation below the red end of the spectrum. If the energy earth takes in from the sun is greater than

energy radiated out by earth into space, the earth's temperature rises. If our earth loses more energy than it gains, it cools. Earth's energy balance—its temperature—needs to be relatively constant for the planet to remain habitable.

Enveloping the earth is its atmosphere. The atmosphere is a protective layer of air situated between us and the sun, and between us and outer space. Among its many functions—like providing the air we breathe—the atmosphere controls energy exchange between the earth and sun and between the earth and outer space. It does this by means of “doorkeeper” gases. Doorkeeper gases—such as carbon dioxide and water vapor—let most of the sun's energy move through the atmosphere to the earth. But these very same gases restrict and delay the flow of energy that the earth radiates into outer space. They do this because they are more transparent to visible light than to infrared radiation. The result is that the earth keeps warm—but not too warm—so that life flourishes. The doorkeeper gases help make a habitable earth.

Window glass in our cars, homes, and greenhouses works similarly. Such glass lets visible light through to the interior but does not let much infrared radiation out. So the inside of our cars, homes, and greenhouses warms up when the sun shines. Because doorkeeper gases act in a way similar to window glass, they also are called “greenhouse gases.” In addition, the effect of greenhouse gases being largely transparent to visible light but not to infrared radiation is called “the greenhouse effect.” For our earth, this greenhouse effect results in just the right amount of energy leaving the earth to balance the earth's energy gain from the sun. This great provision of God for making the earth habitable for living creatures—including us!—brings joy to our hearts and praise to earth's Maker.

If David or another biblical psalmist had known of this provision, we might have a psalm in our Bible that praises God like this:

You energize the earth with an outpouring of light;
you bathe it with empowering rays.
You keep the earth warm as with a blanket;
you keep its heat near your creatures' hearts.
Your biosphere flourishes;
the earth is upheld by sustaining love.

Not all of the sun's energy supports life, however. It also includes harmful, dangerous, and even deadly radiation—powerful invisible rays above the blue and violet end of the spectrum. Maybe you've seen “black lights” that we can install in electrical light fixtures. They give off no visible light, but they make light-colored clothing and various minerals appear to “glow in the dark.” Such “near ultraviolet” light produces radiation immediately above the visible end of the spectrum and is not very dangerous. The next higher level of radiation, however—“far ultraviolet”—is dangerous. When far ultraviolet radiation is absorbed by living and non-living things, not only does it make them warm up, but it transfers such high levels of energy that it ruptures chemical bonds, breaks molecules apart, and disrupts and destroys living tissues. Of particular concern is the breaking of DNA—the genetic blueprint chemical of living things. Damage and breakup of DNA can result in death to cells and microscopic creatures and can affect the instructions given by DNA in ways that produce skin cancer.

But very little ultraviolet radiation ever reaches the earth—and almost no far ultraviolet! It is intercepted in the atmosphere by a “guardian gas” called *ozone*. Sometimes we experience the sharp smell of ozone produced by arcing electric motors or after lightning strikes. This gas can be dangerous for people and other creatures when it occurs in significant quantities near the surface of the earth, and this situation can prompt “ozone alerts” in some large metropolitan areas. In the upper atmosphere, however, ozone is vitally important; the protective “ozone shield” is another of God's remarkable provisions for a habitable earth. If we could collect all the ozone from the upper atmosphere and place it at sea-level atmospheric pressure and at 32 degrees Fahrenheit (0 degrees Celsius), it would be only about one-eighth of an inch (3 mm) thick! And yet that amount of ozone is enough to prevent most of the sun's ultraviolet radiation from penetrating our atmosphere and entering the household of life. That's another reason why God's creatures are able to live on the earth.

If the biblical psalmist had known of this provision by the Creator, we might have a stanza like this in one of the psalms:

The creatures that dwell in the shelter of God's
providence
rest in the shadow of the Almighty.
God covers his earth with a protective shield;
God guards the life he has made to inhabit
the earth.
How great are your provisions, O Lord!
You so love your world that you protect its life!

2. Soil Building

Soils build and develop. We learn something of this from gardening as we spade plants back into the soil and add compost to make it richer. This process of soil building also takes place naturally in fields, forests, and wetlands as organic plant and animal matter partially decomposes and accumulates. In addition, soil is produced and enriched by the weathering of rocks and grains of sand.

Soil gets richer and more supportive of life as it interacts with climate, rainfall, and the myriad organisms that live in it. Topsoil builds up, becoming richer in nutrients and more supportive of plant life. Remarkable cycles are involved in this development of soil: the carbon cycle, the water cycle, the nitrogen cycle—to name just a few. These cycles contribute to a veritable symphony of processes that bring bare landscapes—even bare rock—eventually to support a rich and diverse fabric of living things.

Soil building teaches patience. It can take a hundred years to form an inch (2.54 cm) of topsoil—and yet more often only an eighth-inch (3 mm) of soil is produced in that amount of time! The dynamic fabric of roots, soil organisms, and soils that bind together the surface of the biosphere makes one stand in awe of God's patience as Provider. For “with the Lord a day is like a thousand years, and a thousand years are like a day” (2 Pet. 3:8).

Where does this soil building happen? Everywhere! In the cool of temperate zones this soil building produces our prairie and woodland soils. Farther toward the north pole it produces soils in boreal forests. And in the tropics it produces reddish laterite soils—rich in iron oxides and aluminum hydroxide from the weathering of rocks. All around the world the land is nurtured, refreshed, and renewed in a continuing process.

Soil building helps to hold earth's biosphere together. It helps support creation's integrity by renewing the face of the earth. It is

yet another God-given provision, an expression of God’s bountiful care for the world. If in 1923 Thomas Chisholm had wanted to include this (and the next) provision in his famous hymn about God’s faithfulness, he might have written something like this:

Summer and winter and springtime and harvest,
sun, moon, and stars in their courses above
join with all nature in manifold witness
to thy great faithfulness, mercy, and love.
Air and all elements, marvelously cycling,
tuned to the will of thy most loving grace,
building earth’s soils and supporting thy creatures
steeped in thy love across earth’s wondrous
face.

—adapted from “Great Is Thy Faithfulness,”
Psalter Hymnal, 1987, 1988; 556

3. Cycling and Recycling in the Biosphere

Recycling is not a recent invention. It is part and parcel of the way the world works. The whole biosphere uses, reuses, and uses again the various substances contained in soil, water, and air for maintaining its living and nonliving fabric.

The Carbon Cycle. Carbon is the basic raw material from which the carbon-based stuff of life is made. Even as you read this book, you’re contributing to the process of recycling this remarkable substance. As every living thing—whether human, raccoon, lizard, or gnat—breathes out, carbon dioxide enters the atmosphere. This in turn is taken up by green plants to remake carbon skeletons that give dynamic structure to all life. And this again is transferred to animals and microscopic life that depend on carbon for food—used both for building their carbon-based structure and for meeting their energetic needs. And later they return this carbon to the atmosphere as they again breathe out carbon dioxide or as they die and decay.

The Hydrologic Cycle. Water too is cycled and recycled.

- Taken up in the bodies of animals, water is released again and again through breathing, sweating, panting, and waste discharge. It then reenters the atmosphere, surface water, and groundwater through natural means as well as through our sewage treatment plants and septic tanks.

- Taken up by the roots of plants, water is pumped up through bundles of tubing in roots, stems, and leaves and is evaporated or transpired back into the atmosphere. Other water taken up by plants is used together with carbon dioxide to make the carbon-based stuff of life that, after use by plants and animals as building materials and fuels, is again returned to the atmosphere, surface water, and groundwater.
- The water that goes into the atmosphere—from plants, animals, and people—joins water evaporated from lakes, streams, soil, and other surfaces. This water eventually forms dew, rain, sleet, or snow that again waters the face of the earth. Some of this water is stored in packs of snow high in the mountains, or in glaciers great and small, that in time melt and supply water to streams and rivers below. Still other quantities of this water are stored in wetlands that will also in time slowly discharge it during times of drought. Other water from rain, sleet, or snow runs off to streams, rivers, and other surface waters ultimately to evaporate, again to form clouds. Some water percolates through the soil back to the roots of plants. Some slips past roots to enter the groundwater to be pumped by wells for human use or to emerge again as springs and eventually to return to the clouds from whence it came.

As water is evaporated or transpired to the air, almost everything that was dissolved in it is left behind. This sweet distillation expresses God's bountiful love for the world. And clouds—those great condensations of distilled watery vapors—rain down God's love again to water the earth in snow, dew, and rain. This cycle inspired the writing of Psalm 104:

He makes springs pour water into the ravines;
it flows between the mountains.
They give water to all the beasts of the field;
the wild donkeys quench their thirst.
The birds of the air nest by the waters;
they sing among the branches.
He waters the mountains from his upper chambers;
the earth is satisfied by the fruit of his work.

—Psalm 104:10-13

Cycles upon cycles . . . cycles within cycles . . . cycles of cycles—the creation is permeated with cycles. Each of these is empowered by energy poured out from the sun; each is held together by the power of God’s Son (Col. 1:15-17).

The biosphere—the great envelope of life that embraces the face of the earth—is what we and all God’s creatures inhabit. And all of it relies upon the cycles in creation. The biosphere consists of prairies, oceans, forests, lakes, glades, woodlands, brooks, and marshes. In other words, it is made up of wonderful and highly varied *ecosystems*.

Waubesa Marsh—the wetland on which I live—is one of these ecosystems. Like every other ecosystem on earth, this marsh has its plants, animals, soils, and climate:

- sandhill cranes whose six-foot wingspans, seventy-year lifespans, and bugling calls seemingly command the great marsh.
- iron bacteria whose smallness would escape our notice except for the oil-like film they create over quiet waters.
- deep peat soil at the edge of Lake Waubesa, soil that extends to a dizzying depth of 95 feet (29 m) and holds a record of pollen, seeds, and other remains that define its long history.
- the ebb and flow of water that comes in from rising groundwater, bubbling springs, and falling rain—and then leaves again by means of flowing streams, transpiration through the pores of wetland plants, and evaporation from the many surfaces of land, water, and living creatures.

All of these features and their interactions, and much more, make up the tapestry of this wetland ecosystem. Though it might not seem so at first glance—particularly for wetlands—ecosystems are places of immense ecological harmony. Not every feature plays the same “tune,” but in many ways they are all “in tune” with each other and with the larger systems of which they are a part. Each ecosystem—wetland, forest, prairie, lake, and desert—is a kind of symphony.

The biggest ecosystem of them all—the biosphere—is like a symphony of symphonies. In relationship to each other, all plants and creatures and processes great and small contribute to the ecosystems of which they are a part, maintaining and sustaining the

living structure of the biosphere. They continue to bring forth life from death as they cycle and recycle the basic stuff of creation, all powered by our star, the sun.

4. Water Purification and Detoxification

Taking a cue from nature, many water treatment plants in our cities purify water by filtering it through beds of sand in a process called *percolation*. Water that percolates naturally through the soil is purified in the same way, but usually over greater distances through soil and rock to the groundwater below. By the time it joins with groundwater that we can pump up to our homes from wells, this percolated water is usually fit to drink. This same purified water eventually also emerges from springs that feed wetlands, lakes, and streams.

As we have seen in the description of the hydrologic cycle, purified water is returned to the air by evaporation from the surfaces of water, land, and organisms, and from transpiration through the pores of leaves. We call this process *evapotranspiration*, or simply *ET*. ET from plants around the globe is essential for returning water to the atmosphere.

Flowing waters and their living inhabitants also serve as water purifiers. Normal levels of nutrients that enter streams from the land are processed by stream life. If not overloaded, this “ecosystem service” is another of God’s important provisions that serves the biosphere well.

In addition, wetlands of many kinds across the globe act as water purification systems. Wetland plants filter out eroded soil carried by moving water and draw dissolved chemicals out of the water as they take up nutrients for growth. Mercury and other toxic heavy metals, for example, are taken up by wetlands and stored in the peat soils they form below. The result is that wetlands produce clear water for rivers and streams, thus keeping flowing waters and lakes habitable. Water clarity allows sunlight to reach aquatic plants, and water purification allows for fish and other aquatic life to flourish.

There is wonder in all of this! God remarkably provides for the production of pure water in nature. Contaminated again and again by sediments and dissolved substances, water is made pure again and again . . . and yet again!

5. Fruitfulness and Abundant Life

Creation is blessed with fruitfulness and abundant life! Life's home is the beautiful fabric of living things that envelops the entire earth—the wonderful fabric we call the biosphere. This fabric includes 250,000 species of flowering plants—orchids, grasses, daisies, maples, sedges, lilies—in amazingly colorful abundance and beauty. All of these interrelate with water, soil, air, and numerous organisms as they live interdependently and yet in their own distinctive ways. Beyond these are millions of other species of living creatures—all connected in a web of intricate dynamic interrelationships.

Millions of Fruitful Species. When I was in the ninth grade, I learned that there were about a million different kinds of living creatures. By the time I was in graduate school, I was taught that there were about 5 million species. Scientists today estimate that there may be up to 40 million species of living things on earth! The biodiversity of earth is so great that we are only just beginning to name its creatures. So far we have named only about 1.5 million species.

It is difficult to convey my utter amazement at the seemingly infinite variety of life on earth. I'm even more amazed that despite the dangers nearly every species faces as it goes through its life cycle, most species persist generation after generation, reproducing according to their kinds. Even in naturally occurring shifts in climate, landscape, forest cover, and other environmental surroundings, species persist from generation to generation because they can adapt to changing conditions. Each generation even has its own variety—hardly any two offspring are exactly alike. Such variety produces individuals that are endowed to adapt to new and unanticipated changes in their environment. God not only provides for each species to continue into future generations but also gives each one the blessed adaptability to flourish in new and changing situations. In other words, life not only persists—it flourishes.

Again we can turn to the psalmist to lead us in praise:

How many are your works, LORD!
In wisdom you made them all;
the earth is full of your creatures.

There is the sea, vast and spacious,
teeming with creatures beyond number—
living things both large and small.

—Psalm 104:24-25

I remember vividly a reading of Genesis 1 by Atibisi, an African palynologist (palynology is the study of pollen found in wetland peat deposits). She sat on the floor with a group of us scientists and theologians in a meeting room in Malaysia prior to deliberations on the status of God's creation and our stewardship. She recited the first chapter of Genesis with awesome wonder and God-praising joy. This scientist, who used pollen profiles in layered peat deposits to unpack earth's record of seed plants going back to the earliest days of African agriculture, read the passage as an African storyteller. At the conclusion of her reading, this scientist proclaimed, "This is so true; never has there been written a more beautiful and truthful account of the coming of the biological diversity of our Lord's earth! 'Let the waters bring forth swarms of living creatures, and let birds fly above the earth across the expanse of the sky.' . . . And the Lord blessed them and said, 'Be fruitful and increase in number and fill the water in the seas, and let the birds increase on the earth'" (see Gen. 1:20, 22).

God causes the waters to bring forth swarms of creatures, and creation is blessed with fruitfulness. God's blessing is everywhere evident; it is awesome and wondrous!

Habitats. Although the Creator asked Noah to make special provisions and arrangements for the animals on Noah's ark (Gen. 6), that ship would not have been the best place for animals to live out their entire lives. Neither is a zoological park or a botanical garden! Thinking of Noah's ark and zoos and botanical gardens brings to mind the importance of habitats in the lives of earth's creatures. The ark needed someone like Noah, a zoo needs a zookeeper, and a botanical garden needs a gardener. But a natural habitat needs none of those—only the sustaining provision of the Lord. While human safeguarding and restoration of habitats can be helpful and necessary after human alteration or destruction, habitats are by nature self-sustaining and have existed in some form throughout the histories of the various species present with us on the earth today.

A habitat provides all the requirements needed by a living species to be fruitful and multiply. It allows a species to fulfill its role or “ecological niche” in the biosphere. Remarkably, with the great variety of ecosystems across the face of the earth and through the interrelations of geography, soils, climate, and living creatures, habitats are continuously being sustained and renewed. Often the actions of some species help produce the conditions required by other species. Added to this complexity is flexibility for the requirements of migrating animals. Shorebirds, for example, need a chain of favorable habitats along migration routes that for some species span ten thousand miles (16,000 km).

The distribution of living creatures and their habitats around the globe is the subject of *biogeography*. The biogeography of a given species is described by the size and geographic distribution of its supportive habitats. Variations in climate, soils, and many other factors produce biogeographic patterns and structure. Tundra habitats, for example, are found near the poles and high in mountains; deserts are often in the rain shadows of mountain ranges; and deciduous forests flourish in the mid-latitudes of the southern and northern hemispheres.

In their remarkable diversity, patterns, and supportive features, habitats are still another of God’s bountiful provisions for life on earth. This provision—with its patterned structure, now so evident in satellite imagery of the earth—beautifully makes God’s glories known.

The Fabric of Energy Relationships. Already we have briefly recognized that our star, the sun, energizes every green plant on earth and all creatures that eat them. The word *trophic* is from a Greek word that means “to nourish.” Relationships that transfer nourishing energy from one species to another are called *trophic relationships*. These relationships are extremely important in the networking of living things across the entire world.

Green plants are at the first trophic level, meaning they get their energy directly from the sun. Other parts of God’s creation—including us—receive energy indirectly from the sun by eating plants or by eating animals or other organisms that get their energy from plants. Rabbits are at trophic level 2 because they eat only plants. Bald eagles are at a higher trophic level because they eat fish that eat either plants or other things that eat plants. Everything that is not a green plant depends on eating living things for its energy. God’s

creatures produce and consume, multiply and diminish, develop and decompose, each depending directly or indirectly on the sun's light and each having a particular role in sustaining biospheric integrity.

Why must most plants be green? Because they contain green chlorophyll and are thus the only organisms on earth that can engage in the remarkable process of photosynthesis. Photosynthesis, the foundation of trophic relationships, is the means by which the sun's energy is captured by green plants for the benefit of all other living things on earth. Energy is the "currency" of creation's economy, and photosynthesis undergirds the trophic fabric that interlaces all of life.

A great provision by God, then, is (again) the sun. Another is photosynthesis, which converts solar energy into a form that plants and other creatures can use. Still another is the meshwork of trophic relationships that provide all earth's creatures the energy they need in order to live, reproduce, and flourish.

We—all creatures great and small—depend on these provisions for life. All of these are God's provisions—for which people pray and ravens call. "The lions roar for their prey and seek their food from God" (Ps. 104:21). And so God not only asks Job, "Where were you when I laid the earth's foundation?" but also inquires, "Do you hunt the prey for the lioness and satisfy the hunger of the lions . . . ? Who provides food for the raven when its young cry out to God . . . ?" (Job 38:4, 39, 41a). The answer is clear: God is their provider.

As we ponder these amazing discoveries in creation, our understanding of the symphonies of the biosphere grows. Along with the symphonies of trophic relationships and photosynthesis, there is even the symphony of "peculiar honors" each creature brings to creation's King.

Jesus shall reign where'er the sun
Does its successive journeys run;
His kingdom stretch from shore to shore,
Till moons shall wax and wane no more.
Let every creature rise and bring
Peculiar honors to our King,
Angels descend with songs again
And earth repeat the loud Amen.

—Isaac Watts; *Psalter Hymnal*, 1959, 1976; 399

6. Global Circulations of Water and Air

Because of its 23½-degree tilt, our earth is unequally heated from season to season. The northern hemisphere gets far more solar radiation in summer than in winter. The opposite is true of the southern hemisphere. Besides these seasonal differences there are, of course, daily differences brought about by the rotation of the earth, which provides night and day, coolness and warmth, in a 24-hour cycle.

These seasonal and daily differences drive the flows of both water and air from place to place. Constraining and shaping these circulations, however, are land masses, ridges, valleys, and mountain ranges—both above and below sea level. The movements of water and air combine with all other symphonies in the biosphere to sustain life on earth.

As water and air circulate around the globe, they transport many different things such as carbon dioxide produced by animal and plant respiration, oxygen produced by photosynthesis, and water vapor breathed out by earth's creatures and evaporated from moist and wet surfaces. Carbon dioxide produced by animal and plant respiration is moved and mixed in the atmosphere in ways that bring it into contact with plants. Then plants take up this vital gas to use it in building the carbon backbone of all plant life and the animals that feed on it. Oxygen produced by photosynthesis is similarly circulated by air and water to supply vital respiration and energy conversion for animals and plants.

Global circulations are also vital movers of water vapor. The water put into the air by evaporation and transpiration rises to form clouds that in turn blow across land and sea to bring water to other places as rain, sleet, or snow. Global circulations are the ventilation system of the biosphere. Global circulations provide the “breath of life” on a planetary scale and are vital to the watering of God's great biosphere—the intricately interwoven fabric of life that envelops the earth.

If biblical psalmists had known of these global circulations and of creation's dependence on them, we might have had a psalm in our Bible that went something like this:

You refresh the creatures with vital breath;
you bathe your works in winds of life.

Your providence is everlasting.
Pastures green breathe life to flocks,
to which your sheep return their wind.
Creation is securely held by your grace.
You ventilate the land and aerate your creatures.
Your blowing renews the face of the earth.

7. Human Ability to Learn from Creation

God endowed human beings with the ability to learn from creation. The precious gift of being able to learn from the “beautiful book” of nature gives us the ability to observe, behold, investigate, and record in our mind’s eye what we see, feel, hear, and smell. The images and ideas that then take shape in our minds help us plan and do our work in this world to the glory of our Creator. The learning we gain is also continually tested against our experience. We learn from our mistakes, learn from others whose observations and experiments we trust, and revise our models of the world to better represent the reality of the creation we live in.

This ability to learn from creation comes from God. A 1975 study of the *Hanunóo* tribe in the Philippine Islands, for example, found that an average adult from the tribe could identify 1,600 different species—all without the help of botanical science. These people had knowledge of some 400 more plant species than were previously recorded in a modern systematic botanical survey. What’s more, they also knew how to use these plants for food, construction, crafts, and medicine. And they knew where to find all of them—they knew the plants’ habitats and their ecology. Studies have produced similar findings in other areas of the world, such as Nigeria.²

The ability to build mental models and images of all aspects of creation—from atoms to plants to habitats to the cosmos—is essential for meaningful human life. These models are nurtured, transferred, and refined by our human culture, which is also a gift from God. Early in life we learned the warmth of our family’s love, and we grew with love for our Creator as we learned about life in our community, school, and church family. We now con-

²Awa, N. “Participation and Indigenous Knowledge in Rural Development.” *Knowledge* 10:304-316, 1989.

tinue enjoying these blessings daily as we also learn in our vocations and from the people and other communities around us.

Along the way we often are “re-minded” by people we meet and by places we visit. And in doing this, we may have to reevaluate what we hold in our minds to be true. We might even change our minds as we learn. In divine providence our minds are informed, cultured, and cultivated by learning from God’s world and God’s Word.

One way this can happen is by being “re-minded” that “the earth is the LORD’s, and everything in it” (Ps. 24:1). Our minds may be cultured by the teachings of the Bible to learn of the One through whom all things were made, all things hold together, and all things are reconciled to God—as we read in Colossians 1:15-20. We might even follow biblical teachings that encourage us to be like-minded with Jesus Christ, who reconciles all creation to its Creator. Learning to adopt the mind of the Creator, Sustainer, and Reconciler is a joy and task that lasts a lifetime. Christian culture brings people to pray,

May the mind of Christ, my Savior,
live in me from day to day,
by his love and power controlling
all I do and say.

—Kate B. Wilkinson; *Psalter Hymnal*, 1987; 291

What does it mean to adopt the mind of Christ, of whom it is written:

The Son is the image of the invisible God, the firstborn over all creation. For in him all things were created: things in heaven and on earth, visible and invisible, whether thrones or powers or rulers or authorities; all things have been created through him and for him. He is before all things, and in him all things hold together. And he is the head of the body, the church; he is the beginning and the firstborn from among the dead, so that in everything he might have the supremacy. For God was pleased to have all his fullness dwell in him, and through him to reconcile to himself

all things, whether things on earth or things in heaven, by making peace through his blood, shed on the cross.

—Colossians 1:15-20

The Creator, in providing for all people, has given us minds and the capacity for mindful nurture of worldviews that allow us to image how the world works, to understand our place in it, and to act on our understanding in wisdom. We have been given the gift of being able to know God from his created world and from his Word, and to act on that knowledge to care for each other and for all creation. This provision allows us to adopt the mind of Christ, learning from the book of God's world and the book of God's works, to safeguard the integrity of creation and sustain and renew the life of the earth, in harmony with God's love for the world.

Suggestions for Group Session

GETTING STARTED

We can easily be distracted from considering closely God's provisions for us and for the rest of creation. Many people get so fully occupied on the treadmill of busyness that there is little time to reflect on God's amazing gifts. The air we breathe, the rain that waters the land, the new life that breaks forth from tiny seeds—often we take all of this for granted. We might never pause to think of the wheat plants whose fruit we enjoy every day, or of the remarkable beauty of the leaves we enjoy in our salads, or of why we never have to rake the leaves that fall in the forest. The greatest gifts are free. God pours out these gifts to each of us—and to all creation—every day and hour. This chapter celebrates these gifts.

Opening

If you are meeting as a group for the first time, I suggest that you begin by each mentioning a part of God's creation for which you are especially thankful. You might wish to include a recent experience in which you've particularly enjoyed some aspect of the creation, large or small. If your study of this is personal, you might want to pause and reflect on these things, and perhaps make an

appropriate entry into your reflective journal (see Using this Book at the beginning of this volume).

Then you might enjoy reading these words from *Our World Belongs to God: A Contemporary Testimony* (para. 9):

God formed sky, land, and sea;
stars above, moon and sun,
making a world of color, beauty, and variety—
a fitting home for plants and animals, and us—
a place to work and play,
worship and wonder,
love and laugh.
God rested
and gave us rest.
In the beginning
everything was very good.

You might then enjoy thanking God for these and other provisions in creation, giving praise, perhaps, to Jesus Christ, whom the Bible presents as the one through whom all things were created, hold together, and are reconciled to their Creator (Col. 1:15-20).

If you are discussing this chapter in a group, you may also wish to read Psalm 104 together.

FOR THOUGHT AND DISCUSSION

Here are some suggestions for a variety of activities you can do as an individual or in a group. You might not have time to do them all, so just choose the questions and activities that you think are most appropriate.

From this chapter

1. This chapter describes seven provisions that God has established for creation. Talk about one or two of these that impressed you most. Or maybe one of these provisions surprised or delighted you because you hadn't noticed it before, or had forgotten about it. What do these provisions tell us about creation? What do they tell us about God?
2. What other provisions has God given us in creation? Try to identify one or two more than the seven identified in this chapter. How many provisions do you think there are? Do you

think you could describe them all? Explain. (If you have time, you might tie this discussion in with a reading of some of the poetry in Job 38-41.)

From the Bible

3. Read Romans 1:20. What does this verse say about God's self-revelation in nature?
4. What does Colossians 1:16-17 say about God's continuing care for creation?
5. Read Psalm 19:1-6. What does this passage say about creation's response to God?

From your experience

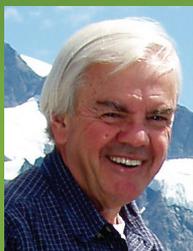
6. How does God express love for the world? On a large sheet of paper, make a list of all the ways in which God shows love to the world. You may want to divide into small groups of three or four persons to come up with ideas. Think of the teachings of the Bible and about the evidence we see in creation of God's love for the world. Confine your list to the left half of your sheet of paper.
7. How might we image God's love for the world? On the right side of your paper, jot down ideas on how we can act to show God's love and care for creation. Try to pair each idea with a corresponding item in the left column.

PRAYER

In prayer you might wish to give thanks for God's creation, provisions, love, and care for the world. You could conclude with praise to God for Jesus Christ, God's one and only Son, our Savior, in whom all things hold together and are reconciled to God (Col. 1:15-20) and whose incarnation and resurrection give hope to the world.

Earthwise is about living in harmony with the natural world around us—and sharing the joy of this living.

Sadly, our ways of life in today's global economy have led to increasing land and habitat destruction, pollution, species extinction, buildup of "greenhouse gases," and other degradations of the earth. But rather than grovel and wring our hands in despair, lifelong creation care scientist Calvin B. DeWitt suggests we discover a joyful, positive attitude about working together for good in this world. Looking forward in hope, we can make changes and take positive, lasting action that is more in harmony with the way the world works and is meant to be. This book, now in its third edition, helps to provide us and our friends, neighbors, coworkers, and fellow citizens with practical information and ideas to become truly "earthwise."



Calvin B. DeWitt is a professor in the Nelson Institute, University of Wisconsin-Madison, where he serves on the graduate faculties of Environment and Resources, Water Resources Management, Conservation Biology and Sustainable Development, and Limnology and Marine Science. His

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